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Soil Survey

of

Valley County, Nebraska

By

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and

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United States Department of Agriculture

Bureau of Chemistry and Soils

In cooperation with the University of Nebraska State Soil Survey
Department of the Conservation and Survey Division

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SOIL SURVEY OF VALLEY COUNTY, NEBRASKA[1]

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INTRODUCTION

Valley County, Nebr., has a continental climate. The county lies in an area of moderate though well-distributed rainfall and of moderate mean annual temperature, with cold winters and warm summers. The climatic conditions are favorable for diversified agriculture which here consists chiefly in growing feed crops, such as corn, oats, alfalfa, and native pasture and hay grasses, and in raising cattle and hogs.

The area included in this county is part of a formerly nearly level or rolling plain, on which minor relief has been produced by stream erosion and wind action. All the county, except a few square miles in the extreme northeastern corner and narrow strips in the larger stream valleys, which are covered with sand, is mantled to various depths with light-gray floury and limy silt, known geologically as Peorian loess. About 85 percent of the land is upland, and the remainder consists of terrace land and bottom land.

This county lies in the black soil plains of central United States. The native vegetation in areas where virgin sod remains consists largely of big bluestem, little bluestem, and grama. The natural forest, which in most places is sparse, occurs only along drainageways, and it is composed chiefly of elm, ash, cottonwood, boxelder, and willow trees.

Practically all the county is well drained, and over rather large areas throughout the loessial uplands in the northern part, surface run-off is rapid and erosion is severe. Narrow strips of severely eroded land also occur along numerous drainageways in all parts of the loess-covered uplands. The only poorly-drained land occurs as small and shallow basinlike depressions scattered over the more nearly level parts of the upland and in local spots on the bottom lands.

On the basis of soil characteristics and other features that affect agriculture, the soils may be separated into four broad groups as follows: Well-drained soils of the uplands and terraces, excessively-drained soils of the uplands and terraces, poorly drained soils of the uplands and terraces, and soils of the bottom lands.

The principal soils of the well-drained upland and terrace group are the Hastings, Holdrege, and Hall. The first two occupy upland positions, and the Hall soils occur on terraces. These soils are well adapted to all farm crops commonly grown in the plains section and are among the most productive in the county. They have all

[1] Report written by F. A. Hayes.

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developed under good but not excessive drainage and have lain in their present positions undisturbed by excessive erosion for long periods. Under the prevailing climate of this region, the accumulation of black well-decomposed grass remains prior to the entry of white men has given the soils thick dark-colored friable topsoils. They also contain an abundance of life, especially in their subsoils.

The excessively drained soils of the uplands and terraces, chief among which are the Colby, Valentine, Dickinson, and O'Neill soils, and dune sand, are not so well suited to grain and tame-hay crops as the well-drained soils of the uplands and terraces, and they are used chiefly for native pasture and hay land. The Colby soils, which are the most extensive, occupy the more rolling parts of the loessial uplands where cultivation is difficult or impossible. Because of the rapid surface run-off, less water has been available for the growth of the native grasses; also surface erosion is greater than on the less hilly land. As a result, the dark-colored surface soil is thinner, and the Colby soils are prevailingly low in organic matter and light in color. The Valentine soils and dune sand occupy the more sandy parts of the county, occurring chiefly in the uplands in the extreme northeastern corner. They are composed almost entirely of loose incoherent sand and are not stable under cultivation. The Valentine soils occupy the more even surfaces and have accumulated enough organic matter to slightly darken their surface layers, whereas dune sand is hilly and practically devoid of organic material.

The O'Neill soils of the terraces and the Dickinson soils of the uplands are also composed largely of loose incoherent sand, but they have accumulated an abundance of organic matter in their surface layers which are prevailingly dark and rather thick. The organic matter loosely binds the sand grains together, and most of the Dickinson and O'Neill soils are fairly stable under cultivation. None of the excessively drained soils of the uplands and terraces, except the Colby, contains lime.

The group of poorly-drained soils of the uplands and terraces includes Scott silt loam and a terrace phase of Crete silt loam. The Scott soil occupies shallow upland basins, and the Crete soil occurs on terraces. These soils have been subject to excessive quantities of water, which has resulted in more or less leached topsoils and extremely dense and claypanlike subsoils. Part of the terrace phase of Crete silt loam is used for corn, oats, and wheat, but practically none of Scott silt loam is cultivated.

The soils of the bottom lands occupy narrow strips in the first bottoms along the larger streams. They include the Cass, Sarpy, and Lamoure soils, and river wash. All these soils are well-drained, considering their low position. The Cass and Sarpy soils have developed from sandy stream sediments and the Lamoure soils from silty sediments. An abundance of organic matter has accumulated in the surface layers of the Cass and Lamoure soils, and they have almost black topsoils. They are among the strongest corn and alfalfa soils in the county. The Sarpy soils are very low in organic matter and light in color. They are used chiefly for pasture and hay land. All the soils of the bottom lands are well supplied with moisture, especially in their subsoils. The Lamoure soils are very limy.

In the diversified-farming system commonly practiced, corn occupies the larger acreage. Its dominance is owing largely to the high-producing power of nearly all the cultivated soils for this crop, especially those of the well-drained upland and terrace group and the darker soils of the bottom lands, which collectively occupy more than half of the total land area of the county. These soils are productive of corn because they have accumulated large quantities of organic matter, and therefore nitrogen, in their topsoils, and because they have high moisture-retaining powers and mellow topsoils and subsoils, which afford easy root penetration. The dominance of corn in the farming system accounts, in part at least, for the large number of cattle and hogs which are annually raised and fattened and which require much corn for feed. Large acreages are also devoted to oats, alfalfa, and other tame-hay crops because they are needed for feed. Some wheat is grown for cash. Practically all the soils on the well-drained uplands and terraces are excellent for wheat, but only a small acreage is devoted to this crop, and cattle and hogs are the chief sources of revenue. Practically none of the feed crops is sold outside the county.

The large number of cattle produced is owing chiefly to the high percentage of grazing and native hay land associated with the land suitable for corn and other feed crops. Much of the area occupied by the excessively drained and the poorly drained soils of the uplands and terraces is suitable only for pasture land and the production of wild hay, and this demands and favors the raising of cattle. Because hog raising is especially profitable when practiced in connection with cattle feeding, the reason for the large number of hogs raised is obvious. Thus it is clear how the type of agriculture which has developed is one fitted to the natural conditions of soil and climate.

Fruit and vegetable crops are of minor importance, and they are grown only to supply the home needs or local markets.

COUNTY SURVEYED

Valley County is in central Nebraska (fig. 1). Ord, the county seat, is about 140 miles west of Omaha. The county is square, each boundary being 24 miles long. It comprises 566 square miles, or 362,240 acres.

The area included in this county is part of a formerly nearly level or rolling loess-mantled plain on which minor relief has been produced by stream erosion and wind action. About 85 percent of the county consists of upland and the remainder of terrace land and bottom land.

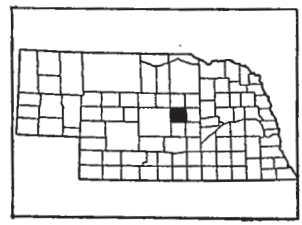

FIGURE 1.—Sketch map showing location of Valley County, Nebr.

Throughout the upland, the loessial mantle, although reduced in most places below the general level of the former plain, remains intact, except in the extreme northeastern part of the county, where the loess gives way to sandy uplands.

The loess uplands are crossed in the northeastern and southwestern parts of the county by North Loup and Middle Loup Rivers, respec-

tively. These streams have cut broad valleys in the loose loessial material and have developed their flood plains in underlying sands. Smaller drainageways, chief among which are Turtle, Myra, Davis, and Dane Creeks, together with their numerous tributaries, ramify nearly all sections of the loessial uplands and produce rather large areas of hilly land, especially in parts of Eureka, Elyria, Noble, Springdale, and Ord Townships; narrow strips of similar land occur along many of the drainageways in all parts of the loessial uplands; and only small tabular areas on the higher divides remain near the level of the former plain.

The drainage system, although intricate, is not deeply entrenched, except along North Loup and Middle Loup Rivers which lie from 80 to 150 feet below the general level of the loessial uplands. The valley sides along these streams range from long and gradual to rather short and steep but are nowhere precipitous. The tributary drainageways are characterized by narrow V-shaped valleys near their heads, but they become progressively wider with more gradually sloping sides near their mouths.

The small area of sandy uplands in the northeastern part of the county occupies only about 14 square miles and lies considerably below the general level of the loessial uplands previously described. Here the surface relief ranges from rolling to hilly. The rougher part occupies only about 3 square miles in the extreme northeastern corner and represents a lobe of the vast sand-hill area of north-central Nebraska. In this section, the sand has been piled into irregularly distributed dunes ranging from 50 to 80 feet in height, interspersed with numerous small enclosed valleys, pockets, and swales.

The rest of the sandy upland occupies a broad comparatively low lying belt between the typical sand hills and the loessial uplands. It is known locally as "Sand Flat" and, although nearly level or gently rolling as a whole, has numerous low rounded knobs and ridges which give it a rather hummocky appearance in places.

The alluvial land, which occupies about 15 percent of the county, consists of smooth plains lying mainly along North Loup and Middle Loup Rivers, partly above the persent flood level and partly below it.

The elevation of the county averages about 2,200 feet above sea level. The highest elevation is on the uplands in the northwestern part and the lowest is on North Loup River, at the point where it crosses the eastern boundary. The elevation of Arcadia is 2,188 feet; of Elyria, 2,103 feet; of Ord, 2,053 feet; of Sumter, 1,988 feet; and of North Loup, 1,965 feet.[2] The general slope of the land is to the south and east.

Practically all the county is well drained, and over large areas in the loessial uplands surface run-off is rapid and erosion is severe. The only poorly drained land occurs locally in the bottom lands and in scattered shallow basins on the more nearly level divides throughout the loessial uplands. Nearly all the drainage in the sandy uplands is subterranean.

Well water of excellent quality is readily obtained in practically all sections. Most of the wells in the uplands range in depth from

[2] GANNETT, H. A DICTIONARY OF ALTITUDES IN THE UNITED STATES. U. S. Geol. Survey Bull. 274, ed. 4, 1,072 pp. 1906.

160 to 225 feet and those in the alluvial lands from 20 to 75 feet. A few flowing wells, ranging from 90 to 120 feet in depth, and numerous springs occur in Spring Creek Valley. Most of the springs issue from the contact zone between loess and an underlying light-colored limy sandstone which outcrops in several places on the lower valley slopes. Spring, Dane, and Messenger Creeks, and North Loup and Middle Loup Rivers flow the year around, but the other streams are intermittent.

Valley County is in the prairie section of the United States, and native forest, mainly of willow, ash, elm, boxelder, and cottonwood trees, grows only along the major streams. The trees are not used for lumber, but they are of local value for posts and fuel. The native grasses, where not destroyed by cultivation, consist largely of big bluestem and little bluestem in the loess-mantled sections and of sandgrass and needlegrass on the more sandy uplands.

The first permanent settlement in the area now included in Valley County was made in 1872, near the present town of Ord on Dane Creek, by a party of Danes from Wisconsin. The county was established and organized in 1873, and its boundaries have remained unchanged.

According to the United States census data, the population steadily increased betwen 1890 and 1920. It was 7,092 in 1890 and 9,823 in 1920. The decade 1920 to 1930 showed a slight decrease, the 1930 census reporting 9,533 inhabitants, all classed as rural. The population is fairly evenly distributed, although it is somewhat denser in the valleys along the rivers and larger creeks than on the uplands, and it is sparsest in the more hilly and more sandy sections.

Ord, the county seat and largest town, located in the central part of the county, had a population of 2,226 in 1930. Elyria, Sumter, North Loup, and Arcadia are smaller towns, each having less than 1,000 inhabitants. All these towns are on railroads, and they furnish good markets and distributing points for farm implements, supplies, and produce.

Transportation facilities are good. A main line of the Chicago, Burlington & Quincy Railroad follows the Middle Loup River Valley across the southwestern part, and a branch line of this system follows the North Loup River Valley across the northeastern part. A branch line of the Union Pacific Railroad also follows the North Loup River Valley to Ord. These railroads furnish good connections with outside points.

The public-road system is well developed. Gravel-surfaced highways pass through all the towns. The county roads are of earth construction and are kept in good repair. Most of them follow land lines, except in the rough areas, where they conform to the topography. Cement or steel bridges and culverts are common, even on the minor roads.

All parts of the county are served by rural mail delivery, telephones are in common use, and the public-school system is highly developed. Churches are numerous and conveniently located, especially in the southeastern section.

CLIMATE

The climate is continental and temperate. Differences in temperature between winter and summer are rather wide, but the climate is

well suited to the production of grain, vegetable, and hay crops, and to raising livestock. The spring season is cool, with considerable rainy weather, which favors the rapid growth of winter wheat and the spring-planted small grains. The summers are long, with warm days and nights, which are especially favorable to the growth of corn. Low temperatures occur rather frequently during the winter but are usually accompanied by snow which protects winter-grown crops from serious injury. The autumns are long and pleasant, with only occasional periods of rainy weather, giving the farmer ample time in which to prepare and seed the land for winter wheat and to harvest the corn crop. Differences in surface relief are not sufficient to cause appreciable differences in climatic conditions within the county.

Table 1, compiled from the records of the Weather Bureau station at North Loup, in the southeastern part of the county, gives the normal monthly, seasonal, and annual temperature and precipitation.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at North Loup, Valley County, Nebr.*

[Elevation, 1,961 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1894)	Total amount for the wettest year (1905)	Snow, average depth
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	25.7	76	−28	0.65	0.28	(1)	4.3
January	21.5	74	−39	.55	.28	1.25	4.7
February	24.8	76	−33	.68	.31	.79	6.7
Winter	24.0	76	−39	1.88	.87	2.04	15.7
March	35.6	90	−19	.99	.92	1.28	5.1
April	49.3	103	6	2.86	1.24	4.59	2.5
May	59.5	100	21	3.63	.69	7.04	.2
Spring	48.1	103	−19	7.48	2.85	12.91	7.8
June	69.3	104	32	4.68	3.05	10.17	.0
July	74.5	107	40	3.70	3.43	8.80	.0
August	72.7	108	34	2.96	.42	2.10	.0
Summer	72.2	108	32	11.34	6.90	21.07	.0
September	64.1	105	20	2.12	1.95	4.23	.0
October	51.6	93	7	1.56	1.55	.42	.9
November	36.8	87	−28	.80	.05	1.63	2.7
Fall	50.8	105	−28	4.48	3.55	6.28	3.6
Year	48.8	108	−39	25.18	14.17	42.30	27.1

[1] Trace.

The average date of the last killing frost is May 7 and of the first is September 22. This gives an average frost-free season of 138 days, which is ample for the maturing and harvesting of all farm crops commonly grown. Killing frosts have occurred as early as September 5 and as late as May 27. During the years from 1895 to 1914 there were 5 in which killing frosts occurred 10 or more days

earlier in the fall than the average date and 4 in which they were 10 or more days later in the spring.[3]

The amount of precipitation differs greatly from year to year. In the 20-year period, 1895–1914, it was less than 85 percent of the mean annual in about one-fourth of the years.[4] About 81 percent of the mean annual precipitation falls from April to September, inclusive, or during the principal part of the growing season. In summer the precipitation usually occurs as heavy thundershowers, although torrential rains are rare. Droughts are almost unknown during May and June, but in the latter part of July and during August short dry periods sometimes occur. However, crops seldom suffer from drought when properly tended, as the soils are usually able to supply them with sufficient moisture during periods of dry weather.

From about October 1 to April 1 the prevailing wind is from the northwest, and during the rest of the year it is from a southerly direction. Strong winds are common, but tornadoes are infrequent.

AGRICULTURE

Prior to the first permanent settlement in 1872, the area now included in Valley County was occupied by Indians, trappers, and hunters, who subsisted largely on wild game, fish, and fruit. The earliest settlers located in the larger valleys, where fuel and water were readily obtained and where the land surface favored easy cultivation. Corn and garden vegetables were usually the first crops planted, and these, in addition to game and beef, formed the chief foods. During 1873 a large influx of settlers homesteaded practically all the valley lands and a large part of the uplands. Crops flourished during the spring and early summer of 1874, but they were almost completely destroyed in late summer by grasshoppers, and the settlers became so discouraged that many of them left. During the next 2 years fairly good crop yields were obtained by the settlers who remained, and immigration was resumed. By 1890 practically all the land was homesteaded. As the settlers became better established, wheat, rye, oats, and barley were grown, but corn has remained the leading crop during most years.

The Federal census reports the value of all crops produced in 1929 as $2,558,129. Dairy products, excluding those used for home consumption, were produced to the value of $394,226, and poultry to the value of $197,105. The total value of all domestic animals on the farms was $2,806,369 on April 1, 1930.

According to the Federal census, about 95.5 percent of the total land area was in farms, with an average size of 267.9 acres, in 1930. About 53.8 percent of the land area was under cultivation, and most of the remainder was in range and pasture land. Corn is by far the most important crop, followed by alfalfa, oats, wild hay, wheat, sweetclover, barley, and rye, ranking in acreage during most years

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[3] REED, W. G. FROST AND THE GROWING SEASON. U. S. Dept. Agr., Off. Farm Management, Atlas of American Agriculture . . . pt. 2, Climate, sec. 1, p. 9 (Advance sheets no. 2), illus. 1918.

[4] KINCER, J. B. PRECIPITATION AND HUMIDITY. U. S. Dept. Agr., Off. Farm Management, Atlas of American Agriculture . . . pt. 2, Climate, sec. A, p. 5 (Advance sheets no. 5), illus. 1922.

in the order named. Minor crops include potatoes, sorgo, pop corn, vegetables, and fruits.

Table 2, compiled from Federal census data, gives the acreage devoted to the principal crops in 1879, 1889, 1899, 1909, 1919, and 1929.

TABLE 2.—*Acreage of principal crops in Valley County, Nebr., in stated years*

Crop	1879	1889	1899	1909	1919	1929
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Corn	2,714	42,104	53,264	90,339	71,166	94,894
Oats	1,273	10,903	9,637	19,630	20,354	24,944
Wheat	4,381	11,561	67,607	25,445	31,105	3,469
Rye	26	574	1,985	285	3,782	502
Barley	367	795	820	271	2,887	4,523
Potatoes		934	853	997	630	607
Hay (all kinds)	983	24,697	20,768	44,614	47,442	43,364
Wild			16,918	22,089	20,931	17,919
Alfalfa			981	19,410	24,155	22,145
Sweetclover (pasture and hay)						[1] 9,681
	Trees	*Trees*	*Trees*	*Trees*	*Trees*	*Trees*
Apples		1,179	11,780	11,765	13,141	7,806
Cherries		1,114	5,019	5,606	4,684	2,241
Peaches		216	603	3,190	130	356

[1] Nebraska agricultural statistics.

Crop yields differ somewhat from year to year, in accordance with differences in the amount and distribution of precipitation and in the length of the frost-free season. They also differ widely on different soils. However, over the county as a whole, the average yields of the different crops over long periods are fairly uniform.

Table 3, compiled from the 1930 Nebraska agricultural statistics, shows the average acre yield of the more important crops during the 18-year period, 1913 to 1930, inclusive. It also shows the approximate percentage of the land area in the county devoted to each crop in 1930.

TABLE 3.—*Average acre yields of the principal crops in Valley County, Nebr., 1913–30, and proportion of county occupied by each crop in 1930*

Crop	Average acre yield, 1913–30	Area of county occupied by crops in 1930	Crop	Average acre yield, 1913–30	Area of county occupied by crops in 1930
	Bushels	*Percent*		*Tons*	*Percent*
Corn	24.8	29.4	Alfalfa hay	2.3	5.9
Winter wheat	16.1	.9	Wild hay	.89	5.3
Oats	31.1	6.5			

The returns derived from livestock constitute an important revenue. According to the Federal census, the value of livestock (including poultry) and their products exceeded that of all farm crops in 1929.

Table 4, compiled from the Federal census reports, gives the number and value of domestic animals and poultry in 1900, 1910, 1920, and 1930.

TABLE 4.--*Number and value of domestic animals and poultry in Valley County, Nebr., in stated years*

Domestic animals	1900		1910		1920		1930	
	Number	Value	Number	Value	Number	Value	Number	Value
Cattle	21,439	-------	32,084	$811,936	33,875	$1,777,521	37,708	$1,710,912
Swine	28,971	-------	54,816	482,648	44,203	933,927	52,593	669,779
Horses	6,982	-------	11,168	1,119,652	10,494	780,743	8,280	365,944
Mules	405	-------	605	66,814	643	77,296	666	38,951
Sheep	1,060	-------	2,416	14,677	3,088	34,312	3,135	20,169
Poultry	51,627	$20,625	89,591	36,343	124,719	107,096	175,803	[1] 97,376

[1] Chickens only.

The farm buildings, in general, are well painted and kept in good repair, and many of the houses are equipped with modern conveniences. In 1930, 149 [5] of the farmhouses had modern heating plants, 198 were equipped with electric lighting systems, and 538 had radios. All farms are fenced, mainly with barbed wire, though many are enclosed with hog-tight woven-wire fencing. The work animals include heavy draft horses and mules. The farm machinery is of the most modern and labor-saving types. There were 250 gas tractors, 162 trucks, 1,312 automobiles, 47 grain threshers, 2 wheat combines, and 978 cream separators on the farms in 1930. Many farms are equipped with corn binders, corn shuckers, hay balers, incubators, and silos. The more expensive farm machinery is sheltered.

In general, farm laborers are plentiful, and the wages paid have been unusually low, especially during the last few years, owing to the economic depression. Monthly farm wages in 1931 ranged from $20 to $30 with board and lodging. Day labor was plentiful at $1 and $1.25. Corn shuckers received 1 or 1½ cents a bushel for shucking corn. Only a few farmers hire help.

In 1930, owners operated 54.9 percent of the farms, tenants 44.7 percent, and managers 0.4 percent. The proportion of tenant farms has steadily increased since 1880, only 4.3 percent of the farms being operated by tenants during that year.

Both the cash and share systems of rental, or sometimes a combination of the two, are followed. Share rental is the most popular, and in 1930, 75 percent of the acreage in tenant farms was rented on the share system. Under this system the owner receives two-fifths of the grain delivered and from $1 to $2.50 an acre for the pasture land and building site. All seed, labor, and machinery are furnished by the tenant. When alfalfa land is rented for shares, the owner receives half the hay stacked in the field. Under the cash system, it is customary for the tenant to pay from $3 to $5 an acre for the use of the land, including the pasture areas. Much of the land suited only for pasture is rented for a lump sum. On some farms the renter is allowed the use of the pasture land without charge. Only a small part of the land suited for grain production is rented for cash.

The Federal census, reporting on 497 farms operated by full owners in 1930, gives the average value of land and buildings as $67.56 an

[5] All numbers in this paragraph are from Nebraska agricultural statistics, 1930.

acre and the average mortgage debt as $29.12 an acre. The taxes on these farms averaged 62 cents an acre in 1929.

According to unpublished records of the Nebraska State Department of Agriculture, 12 parcels of land were transferred in Valley County during the 12-month period preceding March 31, 1931. These transfers involved 2,172 acres, and the average price obtained was $57.87 an acre. The assessed valuation of the land during 1931 was $35.66 an acre. The selling price of individual farms ranges widely, depending on the character of the soil, surface relief, drainage, improvements, and location with respect to markets.

Practically all the crops produced are used in the raising and fattening of livestock. Some wheat is grown to be sold at the local elevators for cash, but the acreage devoted to this crop has greatly decreased in the last decade, and most of the cultivable land is used to produce feed for cattle and hogs which have become the chief source of revenue. The greater part of the feed is used on the farms where produced or sold to cattle and hog feeders within the county.

Many of the feeder cattle are raised locally, and in addition large numbers are purchased when 2 or 3 years old either from the Omaha markets or from ranchers in more western counties of Nebraska. The Federal census reports that 135,741 acres, or 37.2 percent of the total land area, were in pasture land in 1929. This land is rather evenly distributed, and cattle herds, ranging in size from 20 to 300 head, are grazed during the summer in nearly all parts of the county. The native pasture grasses on the hard-land pastures consist largely of big bluestem and grama, which are very nutritious and will ordinarily support from 300 to 350 cattle on each section (640 acres) of land during the grazing season, May 1 to October 1. On the sandy lands the chief grasses are sandgrass and *Stipa*, or needlegrass, which, although not so luxuriant nor so palatable as the hard-land pasture grasses, are able to maintain from 150 to 200 cattle on each section. Little attention is given the grazing cattle beyond furnishing an adequate supply of water and salt.

Cattle to be fattened for market are fed corn and alfalfa for a period ranging from 60 to 90 days and are then shipped, usually to Omaha or Chicago. Many farmers fatten from 1 to 3 carloads of cattle each year, and a few fatten calves for shipment as baby beef to the Omaha market. The calves when weaned are usually fed on oats; the ration is later changed to corn and alfalfa, and the animals are shipped when between 14 and 18 months old. Most of the native beef cattle are of grade Hereford or Shorthorn breeding, and most of the herds are headed by a purebred bull.

Dairy products are an important source of income on most farms. No farm is devoted exclusively to dairying, but most farmers keep from 5 to 10 milk cows, chiefly of mixed beef and dairy breeding, and sell the surplus dairy products to local cream buyers. According to the Federal census, 334,075 gallons of whole milk, 745,645 pounds of cream as butterfat, and 6,304 pounds of butter were sold by the farmers in 1929. Cream routes, along which the cream is collected by the purchaser, are established in some parts of the county, and a cream station is maintained in each town. A large cooperative creamery is in operation in Ord, and a cheese factory is operated at North Loup. Most of the cream not used in

the creamery or cheese factory is shipped to Grand Island, Lincoln, or Omaha. Purebred dairy herds, chiefly Holstein-Friesians, are on a few farms in the vicinity of the larger towns.

Most farmers raise from 20 to 60 hogs each year, and a few have herds of several hundred. Practically all the hogs are raised mainly on corn and alfalfa. Barley and rye are frequently added to the ration. Many hogs are raised in connection with the feeding of beef cattle. All the hogs are of good breeding, and there are many purebred herds, principally of Duroc-Jersey, Poland China, and Hampshire breeds. Practically all the hogs are fattened on the farms where raised, and most of them are sold in Omaha.

Only a few sheep are raised, but some farmers annually ship in a carload or two for fattening. The Federal census reports 13,060 pounds of wool clipped in 1929. The sheep to be fattened are fed corn, alfalfa, and sweetclover, and they are sold on the Omaha market when the price is favorable.

Horses, during several years prior to 1932, declined greatly in value, and horse raising is now of minor importance, although there has been some revival during the last year, and it will probably gain in importance within the next few years. The high cost of gasoline-driven machinery, together with the high tax on fuel, is resulting in an increased use of horses for farm work.

Chickens are a valuable asset on most farms. The local demand for poultry products is good, and poultry raising is receiving considerable attention. Most farmers have 50 or 60 chickens, and many maintain purebred flocks of several hundred. The principal breeds are Plymouth Rock, Leghorn, and Rhode Island Red. The Federal census reports 498,379 dozen eggs and 95,308 chickens sold in 1929. Some farmers maintain their flocks by raising baby chicks purchased from hatcheries in the larger cities. During 1929, 94,824 baby chicks were purchased by farmers. Most of the surplus poultry products are sold or exchanged for farm supplies in the local towns.

Agricultural practices in Valley County are similar to those in other central Nebraska counties. Corn, the leading crop, is planted in May, either with a lister in the furrows between ridges or with a corn planter in checkrows. It is cultivated at intervals of 2 or 3 weeks until early in July, after which it receives little attention until harvest. The corn matures in September or early October. Most of it is husked from the standing stalks, although a few farmers cut part of the crop for fodder, and some cut corn from a few acres for silage. Many farmers annually fence off a few acres of unhusked corn for fattening hogs and cattle. White or yellow dent varieties of corn are grown chiefly. Ordinarily the seed is not carefully selected, but most of it is produced in the locality where it is to be planted and has become adapted to local climatic and soil conditions.

The wheat grown is of the winter varieties, chiefly Turkey, Kanred, and Nebraska 60. The land to be used for this crop is usually plowed and harrowed in late summer, and the seed is planted with a press drill late in September. Some seed is drilled in between the corn rows early in the fall. Wheat usually makes a good start before heavy frosts occur, remains practically dormant during the winter, resumes growth in early spring, and matures in July. It is cut with a binder or header and is either shocked or stacked for threshing. The yield of wheat is sometimes reduced by stinking

smut which distorts the kernels, prevents their normal growth, and gives the grain an offensive odor. This form of smut can be controlled by mixing the seed with copper carbonate powder at the rate of 2 or 3 ounces of the powder to a bushel of grain.[6]

Oats are planted and harvested in the same manner as wheat, but the land is prepared and the seed is planted in spring instead of fall. Kherson, Swedish Select, and Nebraska 21 are the leading varieties. Practically all the oats are fed to horses and calves. The straw, which has some feeding value, is fed to cattle and work animals. Smut sometimes reduces oat yields during prolonged periods of rainy or cloudy weather. However, injury from this source can be controlled by spraying the seed, the day before planting, with a solution of equal parts of formaldehyde and water. One quart of solution is sufficient for treating about 40 bushels of oats.[7]

Barley is planted and harvested in the same manner as oats. The common six-rowed, smooth-bearded varieties are regarded as superior for Nebraska conditions. Practically all the barley is used as hog feed.

Winter rye is generally grown for the grain and to some extent for hay and temporary fall pasture. When planted for grain, it is seeded and harvested in the same manner as wheat. Rye is particularly well adapted to sandy soils. Rosen is the chief variety grown.

Alfalfa is the leading tame-hay crop. Only the most hardy varieties are grown, including Grimm, Common, and Cossack. Thorough plowing, followed by sufficient disking, harrowing, and possibly rolling, to control weed growth and compact the soil, is desirable in preparing the seed bed. The best results are usually obtained by planting the seed after the first heavy rain in spring. Fifteen pounds of good seed to the acre are sufficient in most places. Drilled seed is planted about one-half inch deep. A stand of alfalfa is usually allowed to remain as long as it produces profitably. A field is rarely frozen out. The crop is ordinarily cut three times during the summer, especially in the uplands, and on the bottom lands a fourth cutting is occasionally obtained. The common practice is to stack the hay in the field and haul it to the feed lots as needed, to be fed to cattle and hogs. Many farmers run hogs in the alfalfa fields during the summer, but cattle are seldom allowed to graze on green alfalfa on account of the danger of bloating.

Wild hay is cut chiefly in areas where cultivation is difficult or impractical, as on the more poorly drained parts of the bottom lands, on the steeper slopes, on narrow canyon floors, and on the more sandy and less stable parts of the uplands. The upland hay, as a rule, is of excellent quality, but hay obtained from the bottom lands is usually from water-loving grasses and is rather coarse in texture. Most of the hay is either stacked in the fields or stored in barns for winter feeding, and a small quantity is baled.

The acreage devoted to sweetclover has increased considerably during the last 10 years. This crop is valuable, not only for pasture and hay, but also for seed, for checking erosion, and for increasing the productivity of the soil for grain crops. The plant is a biennial

[6] STEWART, P. H., and GROSS, D. L. SMUT CONTROL IN CEREALS. Nebr. Agr. Col. Ext. Circ. 132, 13 pp., illus. 1929.

[7] STEWART, P. H., and GROSS, D. L. See footnote 6.

and dies at the end of the second season, after producing seed. The most common time of seeding is in early spring. The seed bed is prepared in a manner similar to that required for alfalfa, and the seed is generally sown broadcast and covered with a harrow. When hay is required, the crop is usually cut the first year before the growth becomes coarse and woody. The second year the crop may be allowed to mature and reseed itself, or it may be cut with a binder and threshed for seed. The permanence of a sweetclover stand depends entirely on its ability to reseed, and most farmers take care during the second year not to graze so closely as to prevent maturity of enough of the crop to reseed the land.[8]

Sweetclover has an unusually wide adaptation, as it thrives on both wet and dry soils and on soils of either sandy or clayey texture. It is regarded by most farmers as more satisfactory for soil improvement than either alfalfa or clover. The crop not only adds organic matter to the soil but, in common with other legumes, has the power of fixing atmospheric nitrogen in nodules on its roots. It is a good soil binder and is especially valuable wherever erosion is severe.

Systematic crop rotation is not universally practiced, although most farmers use more or less indefinite rotation systems subject to numerous substitutions. One, which seems to have merit, is corn 2 or 3 years, small grain 2 years, and alfalfa or sweetclover from 4 to 6 years. When alfalfa sod is broken the land is generally used for small grains for 1 or 2 years. On many tenant farms corn is grown on the same ground from 6 to 8 consecutive years. It is considered good practice to plan the rotation system so that about one-tenth of the farmed land may be kept in alfalfa or sweetclover, but this practice is followed only on a few of the bottom-land farms.

Commercial fertilizers are not used. A large quantity of manure is produced, but in general little care is taken to preserve it, and much of its fertilizing value is lost through leaching before it is placed on the land. Most of the manure is hauled in the fall or spring and is usually spread on the land to be used for corn. On tenant farms the greater part of the manure is spread on the land near the barnyard or feed lot.

SOILS AND CROPS

A diversified-farming system, including the growing of feed crops and the raising and fattening of cattle and hogs, is almost universally practiced in Valley County. About 60 percent of the total land area is used for corn, oats, alfalfa, wheat, and other crops common to this climatic section, and the rest, including areas of hilly or extremely sandy land, is used for cattle grazing or the production of wild hay. The farming and pasture lands are rather evenly distributed over the county as a whole, and most farms include a greater or smaller proportion of each, although in some rather large areas one may predominate almost to the exclusion of the other, with the result that the farming system, although diversified, is not equally so in all localities.

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[8] STEWART, P. H., and GROSS, D. L. SWEETCLOVER IN NEBRASKA. Nebr. Agr. Col. Ext. Circ. 122, 15 pp., illus. 1923.

All the county, except a few square miles in the extreme northeastern corner and narrow strips in the larger stream valleys, which are covered with sand, is mantled to various depths by loess, a light-gray floury limy geological deposit, the surface relief of which was presumably plainlike in the past. This material erodes easily, however, and about half the land has been rendered too hilly or steeply sloping for cultivation but is well suited for pasture land. The rest of the loessial material occupies nearly level or gently rolling upland divides, long gradual slopes, and smooth valley floors, all of which are farmed.

Throughout the northern part of the loess-covered uplands and comprising about 30 percent of the county, erosion has been unusually severe. The surface of the loose loessial deposit has been rendered extremely rough and broken by an intricate drainage system. The hills and valley slopes support heavy growths of big bluestem and little bluestem, the roots of which annually supply much black well-decayed organic material. As the surface run-off has been rapid, less water has soaked into the land for the growth of these native grasses, thereby reducing the amount of organic matter produced; and the removal of the surface material by erosion is greater than on less sloping land; so that most of the soils are not only too rough for cultivation but are also prevailingly shallow, low in organic matter, and light in color. About 80 percent of the land is used almost exclusively for grazing purposes.

Throughout the rest of the loessial uplands about 60 percent of the land is admirably suited to cultivation. The drainageways, although numerous, have, as a rule, longer and more gradually sloping sides, especially in their lower courses, than those in the northern part of the county. They are separated by divides of various widths, sizes, and shapes, which have not been greatly modified by erosion, and the relief as a whole has been more favorable to the formation of soil than throughout the loessial uplands in the northern part. Decayed grass remains had accumulated on all except the steeper slopes for long periods prior to the entry of white men, and practically all the soils in the less hilly situations have very dark, many of them almost black, topsoils, owing to an abundance of organic material. The topsoils are also characterized by a pronounced crumblike or granular structure and are easily penetrated by air, moisture, and plant roots. The subsoils are limy, fine textured, and have high moisture-retaining powers. All crops common to the section can be successfully grown on these dark-colored soils of the loessial uplands, but they are used principally for feed crops because most of the cattle and practically all the hogs, which are raised on nearly every farm, are fattened for market and require large quantities of feed. Corn, oats, and alfalfa are grown chiefly, corn occupying considerably more than half the cultivable land on most farms. Wheat, for supplying ready cash, is produced on some farms, but it is of minor importance and is grown only on land not needed for feed crops.

The broad valleys of Middle Loup and North Loup Rivers in the southwestern and southeastern parts of the county, respectively, Myra Creek Valley in the central part, and narrow valleys along most of the larger creeks which ramify the loessial uplands are characterized by soils, most of which have developed from light-

colored alluvial sediments derived largely from the loessial uplands, although a few have developed on sands, especially those occupying bottom-land positions along Middle Loup and North Loup Rivers. The almost total absence of erosion in the valleys has especially favored deep soil development and the accumulation of organic matter, and all the soils, except those on the most recently deposited sands, have deep dark-colored topsoils. The better drained soils, particularly those which have developed from loess, are similar in their main features to the soils in the less eroded parts of the loessial uplands and are used for the same crops as those grown on the higher lying soils. The more sandy and the more poorly drained areas of the bottom-land soils are used chiefly for pasture land and for the production of wild hay.

The small area of sandy uplands in the northeastern part of the county comprises approximately 8 percent of the total area. Throughout about half of this area, incoherent gray sand has been whipped by the wind into mounds, ridges, and hills of different heights. This land supports a rather sparse grass cover, but practically all decomposed plant remains are removed by the wind almost as fast as they are formed, and the soils are prevailingly low in organic matter, light in color, and are of value chiefly for grazing purposes. Throughout the rest of the sandy uplands the surface relief is nearly level or gently rolling. The topmost layer of sand has become more or less mixed with silt, probably blown from the nearby loessial uplands, and has considerable body or stability, even when brought under cultivation. Decayed-grass remains have accumulated in sufficient quantities to produce soils with much darker surface soils than subsoils. These soils are fairly well suited to corn, sweetclover, and, in the lower lying situations where the water table is within reach of roots, to alfalfa. Practically all the area occupied by these soils is devoted to the crops mentioned.

All the cultivated soils, with the exception of a few of the light-colored more sandy or more hilly soils which happen to be included in farmed fields, are well supplied with plant nutrients. They produce high yields of all crops common to the region, provided good drainage is assured. Differences occur in grain and tame-hay yields on the different cultivated soils, but they are due largely to differences in the soil moisture which is controlled by the surface features, particularly the slope of the land and its elevation with respect to surrounding soil areas or to the underlying water table. Differences in the soil-moisture supply are also largely responsible for differences in the agricultural value of the pasture and hay lands. Those occupying the steeper slopes and sharper ridge crests, where most of the precipitation is lost through run-off, support a sparser grass growth than those which have more even surfaces. Also, the more sandy pasture and hay soils, as a rule, are more sparsely grassed than the silty soils, although the growth is more luxuriant in years of subnormal precipitation.

Although the soils of this county differ in their producing powers and crop adaptabilities, they may be placed in groups, each of which includes soils that are fairly uniform in agricultural value and which have a larger proportion of their total area used for some particular crop or crops than is similarly used on soils belonging

to another group. Four soils groups, based on soil characteristics and other features that affect agriculture, are recognized, namely, well-drained soils of the uplands and terraces, excessively drained soils of the uplands and terraces, poorly drained soils of the uplands and terraces, and soils of the bottom lands.

In addition to differences in drainage, the soils differ in other characteristics which affect agriculture, such as surface features, moisture-retaining power, stability, lime content, and erosiveness. No group is confined to any particular part of the county, although some of the soils in each group are local in their distribution.

In the following pages the individual soils of the different groups are described, and their crop adaptations are discussed; the soil map accompanying this report shows the distribution of the soils; and table 5 gives their acreage and proportionate extent.

TABLE 5.—*Acreage and proportionate extent of soils mapped in Valley County, Nebr.*

Type of soil	Acres	Per-cent	Type of soil	Acres	Per-cent
Hastings silt loam	5,184	1.4	Anselmo loamy sand	1,856	0.5
Hastings silt loam, rolling phase	83,200	23.0	Dickinson very fine sandy loam	896	.2
Holdrege very fine sandy loam	4,288	1.2	O'Neill fine sandy loam	1,536	.4
Holdrege very fine sandy loam, colluvial phase	25,088	6.9	Dune sand	2,368	.7
Marshall very fine sandy loam	1,024	.3	Scott silt loam	1,088	.3
Hall silt loam	66,176	18.3	Crete silt loam, terrace phase	576	.1
Hall very fine sandy loam	9,280	2.6	Cass fine sandy loam	4,608	1.3
Waukesha very fine sandy loam	2,944	.8	Cass very fine sandy loam	5,312	1.5
Colby silt loam	71,168	19.6	Cass loamy fine sand	1,472	.4
Colby silt loam, broken phase	54,272	15.0	Lamoure very fine sandy loam	3,840	1.1
Colby very fine sandy loam	7,040	1.9	Sarpy sand	512	.1
Valentine sand	7,168	2.0	River wash	64	.1
Valentine loamy sand	1,280	.3	Total	362,240	------

WELL-DRAINED SOILS OF THE UPLANDS AND TERRACES

The soils classed in this group occupy a large part of the total land area of the county. One or another of them occurs throughout all parts of the well-drained uplands wherever erosion is not severe, and the group includes all but two of the soils on the terraces. They have nearly level or rolling surface relief, and surface and subsoil drainage are adequate. The group includes all the Hastings, Holdredge, Marshall, Hall, and Waukesha soils.

The topsoils of the soils of this group are loose and mellow, are well supplied with organic matter, and are very dark grayish brown or almost black. They are thicker and darker than the topsoils of the soils of any other group, except the soils of the bottom lands. They are prevailingly fine in texture, most of them ranging from silt loam to very fine sandy loam. The subsoils are friable, allowing easy root penetration and free air and moisture movement. They all contain lime in sufficient quantities for crop needs and have high or fairly high moisture-storing capacities, but the depth of the occurrence of lime and the abundance of both lime and moisture differ somewhat in different soils.

Practically all the area occupied by the soils of this group is under cultivation, and the main crops common to the county are produced with good results. Slight differences occur in yields on different

soils, but these are owing more to differences in topographic features, particularly the slope of the land and its elevation with respect to surrounding areas, than to differences in the soils themselves. The upland soils of the group have more sloping surfaces, as a rule, than those on the terraces, and less of the rainfall sinks into them than into those on the benches. In addition, the upland soils are not so favorably situated, except locally, to receive moisture from higher levels as those on the terraces, and they are naturally a little less productive. However, all soils of this group are more productive than any upland soil not belonging to the group, and they are adapted to a wider range of crops than any of the bottom-land soils. Corn is grown on about 65 percent of the area occupied by the soils of this group, oats on about 20 percent, alfalfa on about 5 percent, and wheat on about 2 percent. The rest of the cultivated land is used largely for sweetclover, and rye, barley, potatoes, and other minor crops occupy a few acres on most farms.

Hastings silt loam.—Hastings silt loam occupies a comparatively small proportion of Valley County, but its rolling phase, which will be described later, covers large areas, and the Hastings soils, as a whole, are the most extensive cultivable soils in the county.

Hastings silt loam occurs chiefly in the southern half of the county. The largest area comprising about 1,400 acres, is about 6 miles east of Arcadia. Smaller bodies, few of which exceed 320 acres, are north and northeast of Arcadia and northwest of North Loup, and a few small bodies occur in the northern part. Most areas of this soil occupy the tops of the highest and most nearly level divides, where erosion has been least active. The surface relief ranges from nearly level to very gently undulating.

All of Hastings silt loam has developed from light-gray limy silt (Peorian loess) under conditions of good surface drainage and underdrainage. The topsoil is well supplied with organic matter, is very dark, and ranges in thickness from 15 to 20 inches. It is everywhere loose and mellow, with a well-developed crumblike structure. The upper layer of the subsoil, which is about 20 inches thick, is moderately compact and somewhat cloddy, especially when dry, but the material is not sufficiently dense to restrict root development or the free movement of soil moisture. The lower part of the subsoil, which extends to a depth ranging from 5 to 6 feet, consists of loose flourlike silt and is limy throughout. It is underlain by the gray Peorian loess.

The organic matter, with which Hastings silt loam is so well supplied, is most abundant in the upper 6-inch layer of the topsoil, where it averages about 3 percent by weight of dry soil material and thoroughly impregnates the small crumbs or granules. Between depths of 6 and 12 inches the organic matter is less abundant, comprising only about 2 percent of the dry soil, and is less uniformly distributed than in the layer above, the greater part occurring as coatings on the outsides of the granules. The coatings become thinner with depth, and the soil material becomes lighter in color. The upper part of the subsoil is brown, in contrast to an almost black color in the upper 6 inches of the topsoil. The lower part of the subsoil has received practically no organic matter and is light gray.

Hastings silt loam is well adapted to all crops common to the general region, but in Valley County it is of only local agricultural

importance on account of its small extent. It is not quite so well supplied with moisture and organic matter and is, therefore, a little less productive, especially of corn and alfalfa, than some of the best soils of the terraces and bottom lands, but it is adapted to a wider variety of crops than any soil in the bottom lands. It has a more even surface, is less subject to erosion, and is better supplied with moisture than any of the soils of the loessial uplands, except those in poorly drained basins. This soil is as productive of all crops as any other upland soil of the county, and practically all of it is under cultivation.

Crop yields on Hastings silt loam compare favorably with those obtained on the leading upland soils of the Mississippi Valley, but they are a little more variable than those obtained in more eastern States, owing largely to a slightly greater variation westward in the annual rainfall. Corn yields range from 25 to 65 bushels, averaging about 30 bushels an acre; and wheat yields from 15 to 60 bushels, averaging about 20 bushels. The oat and rye yields are about the same as those of corn and wheat, respectively. The average yield of barley is about 25 bushels, and alfalfa yields from 2 to 3 tons of hay an acre.

Although alfalfa does well on Hastings silt loam, yields of this crop, as on nearly all upland soils in Nebraska, gradually decline after 5 or 6 years, owing to insufficient moisture, and a second cropping to alfalfa is seldom as profitable as the first.[9] The alfalfa plant requires more moisture for its optimum growth than is supplied by the precipitation alone, and when it has exhausted the deeply stored soil moisture, yields naturally decline. Many years are required to replace the moisture removed from the deeper soil layers, even though the land is allowed to lie idle, and reduced yields may be expected from a second cropping to alfalfa throughout the uplands.

The removal of deep-seated moisture in the uplands by alfalfa does not materially affect grain crops, because these crops depend largely on the moisture supplied by the annual precipitation. However, unfavorable yields of grain crops following alfalfa on Hastings silt loam and other upland soils frequently occur, but this is because the moisture from precipitation is insufficient for the increased vegetable growth produced in subsequent crops by the nitrogen stored in the soil by the alfalfa.

Hastings silt loam, rolling phase.—The rolling phase of Hastings silt loam is similar to typical Hastings silt loam in all respects except surface features and thickness of the topsoil. This soil is much more extensive than Hastings silt loam and occurs in all parts of the loess-covered uplands, wherever erosion has not been severe. It has developed from gray Peorian loess similar to that underlying typical Hastings silt loam, but it occupies divides with less even surface relief than those on which the typical soil occurs. Its surface relief in most places is strongly undulating or gently rolling.

The topsoil is more variable in thickness, averaging a few inches thinner than that of typical Hastings silt loam, but areas having

[9] KIESSELBACH, T. A., RUSSEL, J. C., and ANDERSON, A. THE SIGNIFICANCE OF SUBSOIL MOISTURE IN ALFALFA PRODUCTION. Jour. Amer. Soc. Agron. 21: 241–268, illus. 1929.

less than 12 inches of dark topsoil are very few. The upper part of the subsoil is brown and moderately compact, and the lower part consists of light-gray floury and limy silt.

This soil is very well adapted to all the crops commonly grown, but it is not quite so well supplied with organic matter, and therefore nitrogen, as Hastings silt loam. In addition, its less even surface relief favors more run-off, and less of the precipitation sinks into the ground than in typical Hastings silt loam. Practically all this rolling land is topographically suited to cultivation, and, although it gives slightly lower average yields of corn and small grains than typical Hastings silt loam, it ranks among the most productive upland soils of the region and is one of the most important general farming soils in the county. It seems to produce alfalfa as well as any other upland soil, probably because this crop is able to obtain most of its nitrogen from the air and much of its moisture supply from the lower part of the subsoil and from the substratum, but alfalfa yields decline after 5 or 6 cropping seasons, as on typical Hastings silt loam.

Holdrege very fine sandy loam.—Holdredge very fine sandy loam is similar in general appearance to the rolling phase of Hastings silt loam, but it contains a little more sand in the topsoil and has a more friable subsoil. It is also slightly more rolling and much less extensive than the rolling phase of Hastings silt loam. It occurs only where the surface layers of the dark-colored soils of the loessial uplands have become mixed with wind-blown sands from more sandy soil areas.

The soil occupies several small bodies, most of which occur in the northeastern part of the county adjacent to or within short distances of areas of Valentine soils or of dune sand. One of the largest bodies, comprising about 800 acres, is on the east side of Haskell Creek, and a few small bodies occur in the loessial uplands bordering North Loup and Middle Loup Rivers.

The surface relief of Holdrege very fine sandy loam is more irregular than that of the other soils belonging to the group of well-drained uplands and terraces. It ranges from strongly rolling to moderately hilly. The topsoil averages a little thinner than that of the rolling phase of Hastings silt loam, although it is 10 or 12 inches thick. It is well supplied with organic matter and is very dark, except in a few small spots where erosion has been unsually severe. It consists of friable very fine sandy loam or fine sandy loam. The sand content, although noticeable, is not sufficient to make the soil unstable or to detract in any way from its agricultural value.

The upper part of the subsoil resembles the corresponding layer of the Hastings soils, except that it is more friable. The lower part is similar in all respects to the lower subsoil layer of Hastings silt loam, and it rests on light-gray floury and limy loess.

Holdrege very fine sandy loam is well suited to any crop commonly grown in the county, and practically all of it is under cultivation. Its rather uneven surface relief makes it a little more difficult to handle than the more nearly level soils of the uplands, and greater care is required to prevent erosion, but with careful management it is about as productive of all crops as the rolling phase of Hastings silt loam. It is of minor agricultural importance, on account of its scattered distribution and small extent.

Holdrege very fine sandy loam, colluvial phase.—Holdrege very fine sandy loam, colluvial phase, occupies numerous narrow strips and small bodies near the bases of slopes between higher and lower lying soil areas. It occurs in nearly all parts of the county except the northeastern corner. This soil, owing to its lower position, which has favored the accumulation of considerable surface wash from higher levels, has a very friable and slightly thicker topsoil than Hastings silt loam, and in many places this layer attains a thickness of 30 inches. It ranges in texture from silt loam to very fine sandy loam, the silt loam predominating. The subsoil is variable; in one locality it may be moderately compact in the upper part and loose in the lower part, being identical with the subsoil of Hastings silt loam, whereas in another locality it may be friable throughout and similar in all features to the subsoil of Holdrege very fine sandy loam. The density of the upper subsoil layer differs from place to place, but it nowhere becomes too dense to prevent the free movement of roots, air, and moisture. In many places the land has been considerably modified by alluvial deposits and somewhat resembles terrace or bench land, but it is in general more sloping and for this reason is included with the uplands.

This soil is equal to the best soils of the uplands or terraces in natural productivity, and practically all of it is under cultivation, mainly to corn, alfalfa, wheat, and oats, but it is of only moderate agricultural importance, on account of its rather small extent and patchy distribution.

Marshall very fine sandy loam.—Marshall very fine sandy loam occupies several small bodies within or near areas of more sandy soils in the northeastern corner of the county. It has developed on thin remnants of light-gray floury silt resembling the material from which the Hastings and Holdrege soils have developed, but the silt is underlain at a depth ranging from 24 to 36 inches by sand and is thoroughly leached of its lime. It occurs in valleys and swales where it seems to have accumulated through water or wind action. One of the largest areas, comprising about 160 acres, is in sections 10, 14, and 15, T. 20 N., R. 13 W. The other bodies are smaller.

The surface relief is nearly level. Drainage channels are not established, but all the surplus surface water is rapidly absorbed, and the soil is well drained.

The topsoil layer is very dark and ranges from 12 to 16 inches in thickness. It contains a noticeable quantity of very fine sand which is intimately mixed with an abundance of silt and organic matter, a feature which prevents disastrous drifting, even during prolonged periods of dry windy weather. The subsoil consists of light-gray floury silt similar to that in the lower part of the subsoil of Hastings silt loam, except that it does not contain a noticeable quantity of lime. It ranges in thickness from 10 to about 24 inches and is underlain by loose gray sand resembling the sand underlying the Valentine soils and dune sand.

Marshall very fine sandy loam is well adapted to all the crops commonly grown, and practically all of it is under cultivation. It absorbs water more readily than the Hastings and Holdrege soils, and in dry years crop yields are from 5 to 10 percent higher than on

those soils. Its low position favors the accumulation of some moisture through seepage, and in seasons of normal rainfall crop yields may be slightly higher than those obtained on the best upland soils of the county. It is of only local agricultural importance on account of its small extent.

Included with Marshall very fine sandy loam as mapped in this county are a few small bodies, in which the subsoil contains one or more layers of moderately dense and slightly darker material than occurs in the typical subsoil. These layers in few places exceed 3 or 4 inches in thickness and do not seem to alter the agricultural value of the soil. They consist largely of a silt and clay mixture and appear to be the result of water deposition.

A fine sandy loam soil, which resembles typical Marshall very fine sandy loam in most characteristics, is included on account of its small total area. The topsoil has a little more and a slightly coarser grade of sand than that of typical Marshall very fine sandy loam, and it is not quite so well supplied with organic matter. The subsoil also is a little sandier than the corresponding layer in typical Marshall very fine sandy loam. These differences are not pronounced, however, and although the fine sandy loam soil is a little less productive in wet seasons than the very fine sandy loam, it produces good yields of all crops commonly grown. Practically all this more sandy soil is under cultivation. It occurs only in the northeastern corner of the county, where it occupies several small bodies, all of which are closely associated with areas of typical Marshall very fine sandy loam or the sandy Valentine soils.

Hall silt loam.—Hall silt loam occupies the greater part of the terrace land in Valley County. It has developed on light-gray limy silt which has been washed down from the uplands and deposited on the valley floors when the streams were flowing at higher levels. It occurs as continuous strips or elongated bodies of various sizes and shapes in nearly all the larger valleys. Some of the largest developments are in the valleys of Myra Creek, North Loup River, and Middle Loup River. The surface relief is nearly level or very gently undulating. The land lies from 8 to 25 feet above the stream channels and is not subject to overflow. There is sufficient slope down the valleys and toward the streams to afford ample surface drainage, and all the soil has good underdrainage.

Hall silt loam as mapped in Valley County consists of a 15- to 20-inch layer of very dark friable silt loam underlain by about a 20-inch layer of somewhat brown and moderately compact silty clay which, in turn, rests on light-gray floury and limy silt. This soil is almost identical in its characteristics with Hastings silt loam, differing from that soil only in topographic position.

This soil is admirably suited to all crops commonly grown and is considered one of the best general-farming soils. Practically all the land is under cultivation, chiefly to corn, oats, and alfalfa, ranking in acreage in the order named. In seasons of normal precipitation, corn yields range from 20 to 30 percent higher on Hall silt loam than on Hastings silt loam and in dry years are often 50 percent higher. Oat yields also are higher on Hall silt loam, but the difference is not so marked as in the yields of corn. Alfalfa occupies a considerably larger acreage in proportion to the other

crops on the Hall than on the Hastings soil. This crop usually yields from one-fourth to one-half ton more of hay to the acre.

The higher yields on Hall silt loam than on Hastings silt loam are owing more to differences in the moisture supply of the two soils than to soil differences. Hall silt loam naturally receives some water in the form of run-off from the higher lying Hastings soil, which gives it a more favorable moisture supply than occurs in the Hastings soil. Alfalfa not only yields higher on Hall silt loam than on Hastings silt loam, but it can be grown more frequently on the Hall than on the Hastings soil without depleting the deep-seated moisture supply so essential for continued alfalfa production in Nebraska.

Hall very fine sandy loam.—Hall very fine sandy loam resembles Hastings silt loam and Hall silt loam in all characteristics, except in the texture of the topsoil layer. This layer in Hall very fine sandy loam contains a little more of the finer grades of sand than occurs in the corresponding layers of Hall silt loam or Hastings silt loam. Hall very fine sandy loam occupies terraces similar to those on which Hall silt loam is developed, but it is less extensive than that soil. Most of it occurs in the valleys of Middle Loup and North Loup Rivers. The soil has good surface drainage and underdrainage.

Hall very fine sandy loam is as productive and as well adapted to all the crops commonly grown as Hall silt loam. It can be cultivated under a slightly wider range of moisture conditions than the silt loam soil, but this advantage is of minor importance and both soils are regarded with equal favor for general farming. Owing to its smaller extent, Hall very fine sandy loam is not so important agriculturally as Hall silt loam.

Within areas mapped as Hall very fine sandy loam are a few small bodies, in which the topsoil contains an unusually large quantity of fine sand. Were these bodies more extensive they would have been classed as Hall fine sandy loam. A few bodies also occur, in which the dark-colored topsoil is much thicker than that of the typical soil, attaining in places a thickness of 30 inches. These variations are included with Hall very fine sandy loam on the soil map on account of their local distribution and small extent.

Waukesha very fine sandy loam.—Waukesha very fine sandy loam occurs on terraces similar to those occupied by the Hall soils. It occurs in only a few bodies, nearly all of which are in the valley of North Loup River. One of the largest, comprising about 1,200 acres, is about 5 miles north of North Loup in the eastern part of the county. The other bodies are much smaller.

Waukesha very fine sandy loam has good surface drainage and underdrainage, and all of it is under cultivation. It resembles Hall silt loam in general appearance, but its topsoil is somewhat coarser in texture than that of Hall silt loam, ranging from very fine sandy loam to fine sandy loam, the very fine sandy loam predominating. Its subsoil, in most places, is also a little more sandy and more friable than that of Hall silt loam and does not have the moderately compact layer so characteristic of the Hall subsoil. It has a much lower lime content than occurs in the Hall subsoil, but it is not deficient in lime, so far as crop needs are concerned, and is highly retentive of moisture. It is as well adapted to all the crops commonly grown as is Hall silt loam, and it is as productive as that

soil. In fact, the farmers recognize little or no difference between any of the Hall and Waukesha soils in Valley County. The Waukesha soil is of minor agricultural importance on account of its small extent.

EXCESSIVELY DRAINED SOILS OF THE UPLANDS AND TERRACES

The group of excessively drained soils includes the Colby, Valentine, Anselmo, Dickinson, and O'Neill soils, and areas of dune sand. The first four series of soils named and dune sand are in the uplands, and the O'Neill soil occurs on terraces. All except the Colby soils, which occupy the more steeply sloping or more hilly parts of loessial areas and which are composed largely of silt, have developed from materials consisting chiefly of loose sands or gravel and are porous throughout. The sandy soils of the group occur mainly throughout the uplands in the northeastern corner of the county but are also developed on the valley floors and locally on the valley slopes along Middle Loup and North Loup Rivers. The silty soils of the group occur in nearly all sections, except in the extreme northeastern corner and in the flood plains along streams.

A few of the soils of this group have dark-colored topsoils, owing to an abundance of organic matter, but all of them are low in organic matter, in comparison with soils of the well-drained upland and terrace group, and most of them are characterized by decidedly light-colored topsoils. Either because of the steepness of the slopes or because of the porous character of the soil materials, none of the soils belonging to this group is able to retain for crop use as much of the moisture which falls on it as is retained by the well-drained soils of the uplands and terraces in years of normal or above-normal precipitation. However, the sandy soils may retain more in years of less than normal rainfall.

The sandy soils of the group are low in lime, and most of them have rather incoherent topsoils which are subject to drifting during dry windy weather. The silty soils are limy, in many places to the surface of the ground, but in many places they are topographically unsuited to the use of farm machinery.

Only about 50 percent of the area occupied by the soils of this group is under cultivation, the rest being used for pasture or hay land. Corn occupies about 80 percent of the cultivated land, and sweetclover, rye, and oats occupy most of the remainder. Corn is the most extensively grown crop on both the silty and sandy soils, largely because it is needed for feed. Corn does not produce such high yields as are obtained on soils of the well-drained upland and terrace group, but it gives higher returns, especially on the sandy soils, than any of the small-grain crops or alfalfa. Sweetclover is grown on both the silty and sandy soils, most of the rye on the sandy soils, and most of the oats on the silty soils.

Colby silt loam.—Colby silt loam, together with its broken phase, occupies 85 percent of the area included with the excessively drained upland and terrace soils and 34.6 percent of the total land area of county. This soil is a little more extensive than its broken phase. It occurs in all parts of the loessial uplands wherever erosion has greatly thinned, but only locally removed, the dark-colored topsoil so characteristic of the Hastings and Holdrege soils. It is

developed in strips of different widths on the valley sides of nearly all drainageways in the southern half of the county and occurs extensively in many places throughout the northern half.

The topsoil, which averages 6 inches in thickness, ranges in color from dark grayish brown to very dark grayish brown. It consists largely of silt but locally contains a comparatively high percentage of very fine sand. The material is ordinarily loose and friable, but it becomes moderately compact if worked when wet. In most places it contains a moderate supply of organic matter, but this decreases rapidly with depth and is practically absent below a depth ranging from 14 to 18 inches. The subsoil below a depth of 10 or 12 inches is light-gray loose silt with a high lime content.

Many local variations occur. In a few places the topsoil and subsoil are separated by a light-brown intermediate layer ranging from 4 to 6 inches in thickness. The color is caused by the downward leaching of small quantities of organic matter from the surface layers. In many places, where areas of this soil lie adjacent to areas of Holdrege or Hastings soils, the topsoil is considerably thicker than typical, in places extending to a depth of 8 or 10 inches. Throughout the rest of the soil as mapped, the depth of the surface layer depends on the surface relief and the extent of erosion. The deeper and darker soil areas occur on the more gradual slopes where conditions have been most favorable for soil weathering and the accumulation of organic matter. On the steeper slopes, shoulders of hills, and crests of ridges, the dark-colored topsoil has been removed by erosion, and the light-gray limy subsoil is exposed. These variations are too scattered and small in extent to warrant mapping separately.

The surface relief of Colby silt loam in most places is rather steeply sloping or strongly rolling, but in many places it is hilly. The soil is intermediate in relief between the comparatively smooth areas of the Holdrege and Hastings soils, which cap the broader divides, and the extremely eroded and dissected areas of Colby silt loam, broken phase. Drainage is everywhere good, and on most of the steeper slopes it is excessive. Erosion is serious on the steeper slopes, where the land is not properly managed, and the areas of Colby silt loam, broken phase, are gradually extending into areas of the typical soil.

Although the surface relief of Colby silt loam is considerably rougher than that of the Hastings or Holdrege soils, practically all this soil could be farmed, provided the land was carefully managed so as to prevent erosion. Only about 60 percent of the land is under cultivation, chiefly to corn, oats, alfalfa, and sweetclover, ranking in acreage in about the order named. Yields of corn and oats during the first few years after breaking the land are only about 15 percent below those obtained on the thicker and darker upland soils. Alfalfa and sweetclover seem to yield as high on this soil as on any of the upland soils. Unless the Colby soil is carefully managed, erosion rapidly removes the loosened topsoil, forms gullies, and may even render the land uncultivable.

The uncultivated areas of Colby silt loam are used chiefly for pasture land and to some extent for the production of native hay. They support a more luxuriant grass growth than occurs on the broken phase of Colby silt loam and have a slightly higher grazing value.

Colby silt loam, broken phase.—Colby silt loam, broken phase, includes the rougher and more severely eroded areas of Colby silt loam, in which the topsoil has been removed almost as fast as it has formed and the underlying loess formation has been kept at or very near the surface of the ground. A very small quantity of organic matter gives the topmost few inches a somewhat darker color, in most places, than the rest of the soil, but the light-gray limy loess is nearly everywhere within a depth of 6 inches, and it outcrops in many places.

This soil occurs chiefly in the northern part of the county, but it is locally developed wherever the loessial uplands have been subjected to unusually severe erosion. It occupies the greater part of Eureka Township in the northwestern part and covers several square miles south of Ord, south and northeast of Elyria, and northeast and northwest of Sumter.

The surface relief is everywhere rough and hilly, except along the narrow canyon floors which are smooth and gently sloping. All areas of this soil are dissected by intermittent streams which have cut steep-sided and in places almost perpendicular valleys ranging from 75 to 100 feet in depth. Soil slipping is common, and many of the steeper slopes present a succession of short vertical exposures, locally known as catsteps. The divides are sharp and crestlike, and drainage is excessive.

Most of this broken soil is used for grazing land. The only tillable areas are the more gradual slopes, the narrow canyon floors, and scattered included areas of Holdrege soil, which are too small to show separately on the map.

Some of the more severely eroded slopes support only a sparse growth of pasture grasses, but most of the land is covered with a good growth of nutritious grasses, including grama, wheatgrass, and little bluestem. These grasses will support from 100 to 150 head of cattle to the section during the summer grazing season. In the grazing areas the number of animals should be kept well within the carrying capacity of the range, as heavy grazing destroys the protective grass covering and results in excessive erosion.

Colby very fine sandy loam.—Colby very fine sandy loam occupies small bodies and narrow strips in the loessial uplands, chiefly in the northeastern corner of the county, and scattered bodies occur on the valley slopes along North Loup and Middle Loup Rivers and in the adjacent uplands. This soil differs from Colby silt loam only in the slightly higher sand content of its surface layer. It has developed from light-gray limy and floury silt similar to that underlying Colby silt loam, but it usually occurs adjacent to or within short distances of more sandy soils and has received sufficient wind-blown sand to give its surface layer a very fine sandy loam texture.

The surface relief of most of this soil is similar to that characterizing Colby silt loam, but a few small patches of severely eroded and rather rough and broken land are included in mapped areas.

About 80 percent of Colby very fine sandy loam could be farmed if it were carefully managed so as to prevent destructive erosion, but only about 40 percent is under cultivation. The same crops are grown on the cultivated areas as on corresponding areas of Colby silt loam, and the two soils are about equally productive. In fact, the

farmers recognize no difference in the crop-producing values of Colby silt loam and Colby very fine sandy loam, provided comparisons are made on areas having similar surface relief. The uncultivated areas of the very fine sandy loam are included in grazing land, for which they are as well suited as the silt loam.

A few small bodies of Colby fine sandy loam occur in the western part of the county, most of them lying along the Valley-Custer County line. In Custer County, where this soil is more extensive, it is shown on the soil map of that county, but in Valley County it is included with Colby very fine sandy loam on account of its small extent. It differs from Colby very fine sandy loam only in that it contains a little more and coarser sand in its topsoil. It has about the same agricultural value as the finer textured Colby soils.

Valentine sand.—Valentine sand occupies a few bodies of various sizes in Valley County. One of the largest, comprising about 2,000 acres, is adjacent to the area of dune sand in the northeastern corner; some rather large bodies lie north of Middle Loup River in the southwestern part; and the remaining developments, which are much smaller, occur chiefly in the valleys of North Loup and Middle Loup Rivers.

This soil consists of grayish-brown incoherent sand to a depth exceeding 6 feet. The topmost 4- or 5-inch layer has accumulated a little organic matter, and in most places the material is slightly darker than the rest of the soil. However, the organic content is not sufficient to prevent drifting when the native sod is destroyed.

The surface relief of the greater part of this soil ranges from strongly undulating to rolling, and in numerous areas the wind has produced a pronounced hummocky relief. There is no surface runoff, as the precipitation rapidly percolates into and through the porous sand, and as a result the soil has been entirely leached of its lime.

Most of the Valentine sand is of little value for crop production on account of its unstable character and low organic-matter content. Only a small part of it, including areas in the lower lying positions where wind whipping is less severe, is under cultivation, chiefly to corn, though to some extent to sweetclover. The yields of corn are low, except during the most favorable years, but sweetclover does fairly well, even during rather dry seasons, provided a good stand has been obtained. By far the greater part of this soil is used for grazing land, as it produces a fairly good growth of big bluestem, sandgrass, and needlegrass. These grasses will support about 25 head of cattle on each 160 acres during the summer grazing season. Some of the soil is used for the production of wild hay, yields of which range from one-fourth to one-half ton an acre, depending on the rainfall.

Valentine loamy sand.—Valentine loamy sand is an inextensive soil which occurs in scattered bodies, few of which exceed 160 acres in size. Most of them are in the northeastern corner of the county, and a few are on the terraces along Middle Loup River.

This soil differs from Valentine sand only in that its topsoil is better supplied with organic matter and is a trifle darker and thicker. Nearly all of it occurs in close association with Valentine sand, and it usually occupies the more depressed situations where conditions have

been more favorable for the accumulation of organic matter than in areas of Valentine sand.

About 70 percent of this soil is under cultivation and is used chiefly for corn. The fairly high organic-matter content of the topsoil enables it to produce fair yields of corn, especially during the first 2 or 3 years after the land is broken. The organic matter, however, which is not sufficiently abundant to prevent the sand from drifting when the native sod is destroyed, rapidly decreases under cultivation, and the Valentine sand areas are annually becoming larger at the expense of Valentine loamy sand. The average yield of corn during the first 2 or 3 seasons is about 20 bushels an acre, after which the yield is lower, except in seasons of unusually high precipitation.

The uncultivated areas support the same grasses as grow on Valentine sand, but in most places the growth is heavier, and the land has a higher grazing value than Valentine sand. During years of normal rainfall, about 30 head of cattle can be grazed on each 160 acres, or, when the grasses are cut for hay, about one-half ton an acre is obtained.

Anselmo loamy sand.—Anselmo loamy sand differs from Valentine loamy sand only in that it contains a higher proportion of silt, which gives it greater stability and a slightly higher moisture-retaining power than that soil. It occupies several bodies, all of which are in the northeastern part of the county, the largest comprising about 900 acres and the others being much smaller.

The surface relief ranges from gently undulating to rolling, and practically all the land is under cultivation. It is more productive than any of the Valentine soils, owing largely to its higher silt content which, however, is not sufficiently large to prevent the sand—of which the soil is largely composed—from drifting, especially during prolonged periods of dry windy weather, if the cultivated land is left unprotected by vegetation.

Corn is the principal crop, and it yields about 22 bushels an acre during normal years. Some sweetclover is grown and seems to do nearly as well as on the more silty soils of the well-drained upland and terrace group. Small grains are seldom planted on Anselmo loamy sand, on account of the danger of soil drifting, thereby exposing the shallow root systems of these crops to drought.

Although this soil does not have a high organic-matter content, it is more retentive of moisture than any of the Valentine soils. It is of little agricultural importance.

Dickinson very fine sandy loam.—Dickinson very fine sandy loam differs from the Valentine soils chiefly in the darker color and finer texture of its topsoil which averages about 12 inches thick and consists of dark-colored very fine sandy loam containing an abundance of organic matter. The rest of the soil mass is incoherent gray sand similar to that underlying the Valentine soils. Both topsoil and subsoil are low in lime.

This soil occurs in a few small bodies in the sandy uplands throughout the northeastern part of the county. Most of the soil occurs in close association with areas of Valentine or Anselmo soils. The surface relief ranges from nearly level to gently rolling. This soil has developed from almost pure sand which has lain in its pres-

ent position long enough to have accumulated sufficient organic matter to give a pronounced dark color to the surface layers.

Surface drainage is not established, because all moisture is rapidly absorbed by the porous sand. This soil is less retentive of moisture than any of the soils of the well-drained upland and terrace group, but it loses no moisture through run-off, and owing to the high organic-matter content of its topsoil, it is relatively productive, especially in dry years. It retains moisture about as well as Anselmo loamy sand, but it is more productive than that soil, largely on account of the finer texture and higher organic-matter content of its topsoil. Practically all the land is under cultivation. Corn is the principal crop, but small grains also are produced, as the topsoil is sufficiently stable to prevent much drifting even during dry windy weather. Crop yields during seasons of high precipitation compare favorably with those obtained on the Holdrege and Hastings soils of the loessial uplands, and in dry years they are considerably higher, especially yields of corn. This soil is of little agricultural importance on account of its small extent.

O'Neill fine sandy loam.—O'Neill fine sandy loam occupies a few small bodies on terraces, chiefly in the North Loup River Valley. It is developed locally in Middle Loup River Valley. One of the largest areas, comprising about 200 acres, is in the northeastern part of North Loup Township. Most of the other bodies are much smaller.

O'Neill fine sandy loam differs from the Waukesha and Hall soils of the well-drained upland and terrace group in that it has a much coarser texture, especially in its subsoil, than those soils. It has developed from sands and gravels, whereas the Waukesha and Hall soils are derived from silts. It closely resembles Dickinson very fine sandy loam, except that it occupies lower positions, has a slightly coarser texture, and has a little more even surface relief. The topsoil is well supplied with organic matter, is very dark, and ranges from 10 to 14 inches in thickness. It ranges in texture from very fine sandy loam to fine sandy loam, the fine sandy loam predominating.

The high organic matter content of its topsoil gives O'Neill fine sandy loam considerable stability but not enough to entirely prevent soil drifting when the native sod is destroyed. The subsoil is composed of porous incoherent sand and gravel, which are brown in the upper part and grayish brown in the lower. The soil throughout is very low in lime.

The surface of this soil is nearly level, except in a few places where wind action has produced slight depressions and low rounded ridges, but even in these localities differences in elevation in few places exceed 2 feet. Surface drainage is not established.

About 90 percent of O'Neill fine sandy loam is cultivated, and the rest is used for native pasture or hay land. About 90 percent of the cultivated land is in corn, and most of the remainder is in alfalfa or sweetclover. The sweetclover is used largely for pasture. Acre yields of corn average about 25 bushels. Alfalfa, in places where the roots are able to reach the underlying water table, seems to do as well as on the best silty soils of the uplands, but over most of the O'Neill soil yields of this crop are low because of deficient moisture.

It is extremely difficult in most places to obtain a good stand of alfalfa on the O'Neill soil, owing to the loose sandy character of the seed bed. The uncultivated areas have about the same grazing and hay-producing values as areas of the Colby soils. They support a thicker grass cover than any of the Valentine soils.

Included with O'Neill fine sandy loam on the soil map of Valley County are three small bodies of O'Neill loamy sand. One lies along the Custer-Valley County line about one-half mile north of the Chicago, Burlington & Quincy Railroad; one is along the Valley-Greeley County line northeast of North Loup; and the third is west of Fort Hartsuff School in the northern part of the county. The combined area of these bodies does not exceed 200 acres.

This soil differs from O'Neill fine sandy loam only in the texture of its topsoil layer which, in the loamy sand type, is composed largely of the medium and coarse grades of sand, whereas in O'Neill fine sandy loam it is composed chiefly of fine sand and very fine sand. The coarser textured soil is more droughty than the finer textured soil, consequently it is less productive. However, these differences are very slight, and both soils are used for the same crops with about equal results.

Dune sand.—Dune sand occupies less than 4 square miles in Valley County. The largest development, comprising about 1,500 acres, is in the extreme northeastern corner, and the rest is in Middle Loup River Valley near the western boundary.

Dune sand is not a soil. It consists of gray incoherent sand which is almost devoid of organic matter other than that contained in the living grass roots. In most places the sand has been whipped by the wind into irregularly distributed dunes, ranging from 30 to 50 feet in height, separated by shallow swales and pockets, giving the land a decidedly hilly appearance. All the dune sand is used for grazing or for hay land. It is covered with a fair growth of *Redfieldia*, needlegrass, and sandgrass, which will support about 25 cattle on each 160 acres during the summer grazing season, or, when cut for hay, will yield about one-fourth ton an acre.

POORLY DRAINED SOILS OF THE UPLANDS AND TERRACES

The group of poorly drained soils of the uplands and terraces comprises only 1,664 acres in Valley County. It includes Scott silt loam, which occupies shallow upland basins, and Crete silt loam, terrace phase, which occurs in terrace positions. Both soils have developed under extremely poor drainage. The excessive moisture has noticeably leached the lower part of the topsoils and has resulted in the development of dense claypanlike layers in the upper part of the subsoils. Soluble salts washed in from higher lying areas undoubtedly have contributed to the density of the subsoils, especially in the terrace phase of the Crete soil.

The soils of this group are, as a whole, poorly adapted to grain and tame-hay crops. The topsoils in most places are too thin to store much moisture, and the dense clay in the subsoils is, in general, too poorly aerated and releases its moisture too slowly for these crops. Both soils, however, produce luxuriant growths of coarse grasses which are fairly well suited for pasture and hay, and a part of the terrace phase of Crete silt loam is adapted to small-grain crops.

Scott silt loam.—Scott silt loam occupies several small bodies throughout the more nearly level parts of the loessial uplands. Most of them are in the southern and western parts of the county. The largest area, comprising about 100 acres, is about 7 miles east of Arcadia in Yale Township. Few of the other bodies exceed 40 acres in size, and most of them comprise only a few square rods. This soil occupies shallow basinlike depressions, in which water accumulates after rains.

The topsoil of Scott silt loam consists of rather heavy silt loam or silty clay loam and ranges from less than 6 to about 8 inches in thickness. In most places this layer is well supplied with organic matter and is very dark, especially in the upper part. However, it invariably contains some light-gray silty material, from which excessive moisture has removed the black organic matter, and, in many places, especially in the more poorly drained depressions, the lower part of the topsoil is gray. The subsoil consists of dense lead-gray or bluish-gray clay which contains scattered iron stains and concretions and both light and dark spots and splotches, caused by poor drainage. The subsoil is plastic when wet and extremely hard and tough when dry. It extends to a depth ranging from 5 to 6 feet, where it gives way rather abruptly to light-gray floury loess. The excessive moisture has removed the lime from both the soil and the underlying loess to a depth exceeding 10 feet.

Scott silt loam is not suited to the production of grain and tame hay, as most of it is too poorly drained for cultivation. The dense claypanlike subsoil is penetrated with difficulty by roots and practically limits the storage of available crop moisture to the topsoil which is too thin to store sufficient moisture for grain crops, especially during prolonged dry periods. This soil occupies only a small part of the farms on which it occurs and may not seriously affect the general value of the farm land. All of it is either included in pasture or is regarded as waste land.

Associated with Scott silt loam, and also occupying poorly drained upland depressions, are a few small bodies in which the subsoil, although as dense as that in typical Scott silt loam, is black instead of lead gray or bluish gray, and it still retains considerable lime in its lower part. Had these bodies been more extensive they would have been shown separately on the soil map. Owing to their scattered distribution and small extent, they are included with Scott silt loam. None of this included land is well suited to the production of grain and tame hay.

Crete silt loam, terrace phase.—This soil is simply a terrace phase of Crete silt loam which has been subjected to the influence of soluble salts, or "alkali", in sufficient quantities greatly to alter its character. It occupies only 7 or 8 bodies, all of which are on the North Loup River terraces within areas of Hall silt loam. The largest area, comprising about 300 acres, is 1½ miles northeast of Ord.

The topsoil, which ranges from 6 to 12 inches in thickness, differs from the corresponding layer in the alkali-free areas of Hall silt loam in that it is a trifle heavier, a little lighter in color, and contains more or less alkali. The presence of alkali is indicated, especially during dry weather, by scattered spots in which a white efflo-

rescence occurs on the surface of the ground. The upper subsoil layer, which continues to an average depth of 30 inches, consists of dark-brown or grayish-brown extremely compact clay which is plastic when wet and very hard and tough when dry. The lower part of the subsoil is light-gray floury and limy silt similar to that underlying Hall silt loam.

About 70 percent of this soil is used for cultivated crops, oats and wheat occupying about 70 percent of the cultivated land and corn the rest. Alkali is not sufficiently abundant to injure crops, except in spots. The claypanlike layer in the subsoil practically limits the storage of moisture available for crops to the topsoil, and early-maturing shallow-rooted crops naturally do better than those requiring moisture in larger quantities and for longer periods. Wheat and oats yield about as well as on Hall silt loam, but corn yields average about 15 percent lower than on that soil and in unusually dry seasons are only about half as large. The uncultivated parts of this soil are used as pasture and hay land, for which they are well suited.

SOILS OF THE BOTTOM LANDS

The group of soils of the bottom lands occupies 4.5 percent of the total land area of the county. These soils have developed from sediments recently deposited in the bottom land, and they include the Cass, Sarpy, and Lamoure soils, and a material designated as river wash. One or another of these soils occurs in bodies or strips along all the larger and a few of the smaller streams. The largest areas are along Middle Loup and North Loup Rivers.

The surface relief of the bottom lands is remarkably smooth, except where traversed by old and present stream channels or where modified by slight elevations and shallow depressions. Surface drainage, although rather slow, is well established, except locally. Much of the land is subject to overflow during high stages of the streams, but, as most of it lies from 3 to 6 feet above the stream channels, water drains off within a few hours after the streams subside. About 95 percent of the land is adequately drained. The water table ranges from 4 to about 15 feet beneath the surface of the ground, and the subsoil is kept well supplied with moisture, even during the drier years.

The sediments from which the bottom-land soils have developed are of such recent origin that none of them has been altered greatly by processes of soil development, and their composition is the dominant factor in determining the character of the soils. The sediments derived chiefly from the loessial uplands are uniform and silty, whereas those derived from sandy or gravelly materials are comparatively coarse textured. The mixing and reassorting of the fine and coarse particles by streams have given rise to a varied assortment of sediments, especially in the bottom lands along Middle Loup and North Loup Rivers.

The Lamoure soils have developed from the finer stream sediments, chiefly silts and clays, whereas the Cass and Sarpy soils and river wash are from sand and gravel.

The soils of the bottom lands are naturally better supplied with moisture than those of the uplands or terraces, because the precipitation received by them is supplemented by seepage from the underlying

water table and by run-off from higher levels. The run-off carries considerable organic matter and other plant nutrients to the lower levels. The moist condition prevailing in the bottom lands has favored rapid vegetal growth and decay, and all the soils, except the Sarpy, which is developed from very recently deposited sands, have dark-colored topsoils, owing to the abundant accumulation of organic matter. The dark layer in many places is rather thin and disappears rapidly under cultivation, especially in the sandy soils of the Middle Loup River bottoms, and only about 60 percent of the total area of bottom-land soils is used for grain and tame-hay crops. Corn and alfalfa are grown chiefly, in the proportion of about 10 acres of corn to 1 of alfalfa. Considerable sweetclover is grown. Small-grain crops grow well on all the bottom lands having deep dark-colored soils, but, owing to the abundant moisture supply, these crops have a tendency to produce long weak stems which often break during windy weather. In addition, the small grains usually mature late and produce rather low yields of grain.

The uncultivated soils of the bottom lands, including most of those with dark-colored but comparatively thin topsoils and practically all of those with light-colored surface layers, as well as small areas which are poorly drained or forested, are used for native-hay or pasture land.

Cass fine sandy loam.—Cass fine sandy loam occupies the second largest area of the soil of the bottom lands. The largest body comprises a long narrow strip on the south side of Middle Loup River, and smaller bodies lie along this stream and along North Loup River.

The 8- to 12-inch topsoil of Cass fine sandy loam is almost black. It is composed largely of fine sand but contains an abundance of organic matter and small quantities of silt which tends to stabilize the sand. The subsoil is loose gray or grayish-brown sand which in most places becomes coarser with depth and in many places is gravelly below a depth of 3 feet. It may or may not be limy.

The surface relief of this soil is nearly level. The land lies only 3 or 4 feet above the normal level of the streams, but it is well drained, and practically all of it is under cultivation. Corn and alfalfa are the principal crops, although small fields of sweetclover and timothy mixed occur on many farms. Corn and alfalfa yield higher than on any upland or terrace soil and almost as high as on the better drained parts of the finer textured Lamoure soils of the bottom lands.

Cass very fine sandy loam.—Cass very fine sandy loam occupies a slightly larger total area than Cass fine sandy loam. It occurs in numerous bodies and strips throughout the bottom lands of Middle Loup and North Loup Rivers. This soil resembles Cass fine sandy loam in nearly all features except texture of the topsoil, the sand in this layer being of a slightly finer grade than that in the topsoil of Cass fine sandy loam. The topsoil is well supplied with organic matter and is very dark. The subsoil, beginning at an average depth of 10 inches, is gray or grayish-brown loose sand which gradually becomes coarser with depth and in many places is gravelly in its lower part.

The surface relief of Cass very fine sandy loam is nearly level, and, as a rule, the land lies slightly below that of the associated

Cass fine sandy loam areas. The underlying water table is nearly everywhere within a depth of 4 feet, and in wet years it rises sufficiently to produce small areas of marshy land. Only about 65 percent of this soil is sufficiently well drained in all years for cultivated crops, and the land is used chiefly for corn. Where adequate drainage is assured, corn yields are as high as on any of the other bottom-land soils, except Lamoure very fine sandy loam, and are greater than on any upland or terrace soil. Alfalfa yields are high during the first few seasons, but the exceptionally wet subsoil seems to be unfavorable in most places to alfalfa roots, and yields of this crop decline in subsequent seasons.

The poorly drained areas support a luxuriant growth of water-loving grasses which will support a cow on each acre during the summer grazing season or will yield from three-fourths to 1 ton of hay.

Cass loamy fine sand.—Cass loamy fine sand occupies scattered bodies in the bottom lands of Middle Loup and North Loup Rivers. One of the largest areas, comprising about 640 acres, is on the north side of Middle Loup River in Arcadia Township. The other bodies are smaller. The total area of this soil is small.

This soil differs from Cass fine sandy loam only in that it has a slightly coarser textured topsoil and a little less even surface relief. Its topsoil is composed largely of fine sand or medium sand, containing sufficient organic matter to give the material a dark color but not enough to entirely prevent soil drifting, especially when the land is brought under cultivation. The subsoil is similar to that underlying the other Cass soils.

The surface relief is gently undulating, except locally where wind action has produced low ridges, hummocks, and shallow depressions, but the difference in elevation in few places exceeds 3 feet. The elevation is greatest in areas where the organic content of the topsoil is lowest. Areas of Cass loamy fine sand lie from 3 to 5 feet above the normal stream levels, and the topsoil, except in local depressions, is well drained. The underlying water table is everywhere within 6 feet of the surface of the ground, and the subsoil, except in the driest years, is continually moist.

About 80 percent of this soil is under cultivation, and the rest, including the poorly drained spots, areas in which the topsoil is too unstable for cultivated crops, and areas covered with forest growth, is used for native pasture or hay land.

Cass loamy fine sand, where suited to cultivation, is one of the best corn and alfalfa soils in the county, being only slightly less productive of these crops than Cass fine sandy loam. It is of minor agricultural importance on account of its small extent.

Lamoure very fine sandy loam.—Lamoure very fine sandy loam occupies several bodies in the bottom lands along North Loup and Middle Loup Rivers, the largest occurring on the north side of North Loup River in the vicinities of Ord and Sumter. The total area is not large.

The surface relief of this soil is nearly level. Most of the land lies a little below the level of the surrounding bottom-land soils and is rather poorly drained, especially in early spring, but most of it is sufficiently dry for cultivation by crop-planting time, and about 70 percent of it is used for grain and tame-hay crops.

The topsoil, which ranges from 14 to 18 inches in thickness, is almost black, owing to an abundance of organic matter. It is not very uniform in texture, ranging from silt loam to fine sandy loam within a distance of a few rods. However, the topsoil in most areas averages very fine sandy loam, and on the accompanying soil map all the areas are included with this type. The topsoil is everywhere friable and easily tilled, except in a few of the more silty spots, where it has a tendency to form clods if plowed when wet and is rather difficult to cultivate when dry. However, even the silty spots have good tilth under normal moisture conditions.

The subsoil ranges in color from light gray to almost black but in most places is gray or mottled gray and brown. It consists of heavy silt loam or silty clay loam, but it is not sufficiently compact to prevent easy root penetration and the free movement of soil moisture. The subsoil layer is very limy. Much of the lime, especially in the bodies with lighter colored subsoils, occurs as small hard or soft concretions and in irregular-shaped white spots and splotches.

Lamoure very fine sandy loam where adequately drained is the strongest and most productive corn and alfalfa soil in the county, and the cultivated areas are used chiefly for these crops in the proportion of about 8 acres of corn to 1 of alfalfa. Some sweetclover is grown for pasture. Small grains are of minor importance, being grown only as a step in the rotation between corn and alfalfa or as a nurse crop for alfalfa. On the better drained areas, yields of corn average about 45 bushels an acre and of alfalfa hay about 3½ tons. The more poorly drained areas are used for pasture and hay land.

Sarpy sand.—Sarpy sand occupies small bodies and narrow strips, most of which are adjacent to the channels of Middle Loup and North Loup Rivers. Few of the bodies exceed 80 acres in size.

Most of the Sarpy sand has developed from recently deposited river sands which have not yet accumulated much organic matter. Some of it has developed from Cass loamy fine sand, the topsoil of which has been practically depleted of its organic matter through wind erosion. In some places Sarpy sand resembles river wash, but it is more stable and is not so greatly influenced by each slight rise in the stream.

The topsoil consists of a 6- or 8-inch layer of gray or grayish-brown incoherent fine sand or medium sand. This layer is underlain, to a depth exceeding 4 feet, by material of similar consistence though of slightly coarser texture and lighter color. The surface layer, to a depth of 2 or 3 inches, in most places contains some organic matter and is a little darker than the rest of the topsoil, but the organic content is not sufficient to prevent soil drifting when the native vegetation is destroyed, and it disappears if the soil is overgrazed or cultivated. The soil is not limy.

The surface relief of Sarpy sand ranges from nearly level to gently undulating. The land lies from 3 to 4 feet above the normal level of the streams and, although it is subject to occasional overflow, it is not covered with water except during unusually high stages of the streams, and then only for a few hours. The subsoil is moist but not poorly drained.

Only about 20 percent of Sarpy sand is used for cultivated crops, chiefly corn. Most of the remainder supports a scattered tree growth

and is included in pasture land. Although the organic-matter content is very low, the moisture supply is abundant, and fair yields of corn are obtained on the cultivated areas in most years. The average yield over a period of years is about 20 bushels an acre.

River wash.—River wash is not a typical soil, but it is material formed from recently deposited stream sediments and is therefore included with the bottom lands. It consists of sand bars, islands, and sand flats within or adjacent to the channels of Middle Loup and North Loup Rivers. Only the larger areas are shown on the soil map.

River wash differs from Sarpy sand in its less stable character and the almost total absence of organic matter. It lies only a few inches above the normal level of the streams and undergoes changes with each slight rise of the water. The material represents the first stages of the formation of soil developed from alluvium, and, with the gradual accumulation of organic matter, it will develop into Sarpy soil. Most of it supports a rather dense growth of seedling willow trees and is used as pasture land.

SOILS AND THEIR INTERPRETATION

Valley County is in the black-soil area of central United States. The climate, which is continental and temperate, with a mean annual precipitation of 25.18 inches, has favored the annual growth and decay of a luxuriant grass vegetation. All the soils, except those on the steeper slopes or on the most recently deposited or unstable sands, have accumulated much black well-decomposed organic material from the decaying grass vegetation and have developed dark-colored, in many places almost black, topsoils. The moderate precipitation has not been sufficient entirely to leach the soils of their readily soluble salts, except over local areas where it has been supplemented by run-off or in areas where the soils are unusually sandy and porous. In most of the soils, the soluble salts, chiefly lime carbonate, have been leached only from the topsoils and have accumulated in the subsoils, producing a layer of higher lime content than occurs in any other part of the soil profile. This layer is commonly known as the lime zone.

Most of the soils have developed from remarkably uniform light-gray calcareous silt, known geologically as Peorian loess, but a few, some of which are in the valleys of Middle Loup and North Loup Rivers and some on the uplands in the extreme northeastern part of the county, have developed from sandy or gravelly materials.

The principal soil-forming agencies, climate and vegetation, have, in most places, considerably altered the topmost part of the loess and the saind or gravel, as the case may be, and have produced the present soils. The effectiveness of the climate and vegetation in transforming the geological materials into soils in a particular locality has depended, not only on the character of these materials, but also on the relief and drainage conditions under which they have weathered and on the length of time they have been subjected to undisturbed weathering. Most of the differences in the soils are the result of differences in the surface features, which control the quantity of water entering the soil, and the rapidity of the surface run-off. Especially is this true in all soils developed from the same geological

formations. A few soil differences, however, particularly marked differences in the texture, coherence, and lime content of the subsoils, are largely the result of differences in the geological materials from which the soils have developed.

The soils in level or depressed situations, where surface drainage is slow or absent, have been subjected to the largest quantities of water and show well-marked characteristics, chief among which are more or less advanced stages of leaching, especially in the topsoils, and, unless composed largely of sand or gravel, a large accumulation of clay in the subsoils. On strongly rolling or hilly areas, leaching and the accumulation of clay are negligible, but the rapidity of the surface run-off has greatly thinned or otherwise modified the topsoils through erosion, especially on strongly rolling or hilly areas of the more silty soils. The soils developed from sands or gravels are rather thoroughly leached, regardless of their surface relief. The sandy soils, however, show little accumulation of clay in their subsoils, partly because the quartzitic sands are extremely resistant to weathering and the formation of clay, and partly because the soils are so porous that practically all fine material can pass through them in the underdrainage.

On undulating or moderately rolling areas the silty soils show neither excessive leaching and the accumulation of clay nor evidence of severe erosion. Practically all of them, except those in stream bottoms, show evidence of having developed under good drainage and of having lain in their present positions, undisturbed by severe erosion or excessive leaching, for long periods. They have accumulated an abundance of organic matter and have thick dark-colored topsoils. They have also developed well-defined horizontal layers, or horizons, which occur in a definite order of succession and which differ from one another in one or more easily discernible characteristics, such as color, texture, structure, lime content, and coherence. These soils have been formed under the most favorable conditions for soil development afforded by the region, and they have received the full impress of the regional climate and vegetation and may be regarded as fully developed soils of the chernozem group.

All the rest of the soils have obviously formed under the same general climatic environment as the fully developed soils, and most of them have some of the characteristics common to those soils. However, one or more of the other environmental factors in soil development, such as resistance to alteration, duration of weathering of the parent geological materials, surface relief, drainage, and density of grass cover, have not been so favorable to soil formation as in the fully developed soils. One or more of the soil horizons is absent or poorly defined, and the soils are regarded as imperfectly developed.

Fully developed soils occupy about half the total land area of the county. They include most of the area occupied by the Hastings, Holdrege, Hall, and O'Neill soils, one or another of which occurs in nearly all parts. The Hastings and Holdrege soils occupy upland positions, and the Hall and O'Neill soils are on terraces.

Following is a description of the profile of Hastings silt loam observed on the gently rolling surface of a divide in the central part of Yale township, about 5 miles northeast of Arcadia:

0 to 6 inches, very dark, almost black when wet, friable silt loam. The topmost inch of this layer is structureless; the next lower layer, which is 2½ inches thick, is faintly laminated; and the rest of the horizon is composed of irregular-shaped soft granules, ranging from one-eighth to about one-fourth inch in diameter.

6 to 18 inches, dark grayish-brown granular silt loam which apparently has a slightly higher clay content than the overlying layer, because its granules are a little firmer. The granules are slightly larger than those in the layer above.

18 to 37 inches, grayish-brown silty clay loam which has a cloddy structure and a poorly developed prismatic form. The material is a trifle denser than that in any layer above or below, but the increased density is noticeable only through close comparison with the material of the other layers.

37 to 55 inches, light grayish-brown cloddy or structureless silt loam which retains the poorly developed prismatic form but is very friable and seems to be transitional in character between the material in the overlying and underlying layers.

55 to 75 inches, the lime zone. The prismatic form is not discernible, and the material is structureless. The material in this horizon consists of very light grayish-brown friable silt containing an abundance of lime in spots, splotches, soft and hard concretions, and in finely divided form.

75 inches +, the underlying Peorian loess which, although very limy, contains only a few spots in which the carbonates are visibly concentrated.

All transitions in color, texture, and structure between the different layers are gradual. The upper limit of lime concentration is rather sharply defined, but the lower one is indefinite, and the material in the lime zone grades almost imperceptibly into the parent loess.

The upper layers of the profile are well supplied with organic matter, which accounts for their dark color. The organic material, to a depth of about 7 inches, is rather thoroughly mixed with the soil mass, but below this depth it occurs chiefly as a film or coating on the surfaces of the structure particles. The film decreases in thickness with depth, and below a depth of 37 inches the soil appears to be practically devoid of organic matter.

Table 6 gives the pH values of the horizons of a profile of Hastings silt loam. It may be noted that the lime zone lies at a depth of 57 inches below the surface.

TABLE 6.—*pH determinations*[1] *of Hastings silt loam in Valley County, Nebr.*

Sample no.	Depth	pH	Sample no.	Depth	pH	Sample no.	Depth	pH
	Inches			*Inches*			*Inches*	
378115	0- 5	6.8	378118	26–37	7.7	378121	74- 96	8.9
378116	5–12	7.3	378119	37–57	7.8	378122	96–108+	8.9
378117	12–26	7.4	378120	57–74	8.8			

[1] Made by the hydrogen-electrode method in the Bureau of Chemistry and Soils, U. S. Department of Agriculture.

Aside from slight differences in the texture, thickness, or compaction of some of their layers, most of the fully developed soils have profiles very similar to the one described. In the Hastings soils, which have, as a rule, nearly level surfaces, more of the precipitation sinks into the ground than in the gently rolling Holdrege soils. Consequently, a greater translocation of clay downward has taken place, and the upper subsoil layers of the Hastings soils are consid-

erably more compact than the corresponding layer of the Holdrege soils, but they nowhere attain the density of a claypan.

The Hall soils are very similar to the Hastings soils in all characteristics except topographic position. They occur on well-drained terraces.

The O'Neill soils of the terraces, although fully developed, have been formed from sand and gravel, and they differ from the other fully developed soils in that they are coarse in texture and have been thoroughly leached of lime.

The imperfectly developed soils occur in all parts of the uplands and terraces not occupied by the Holdrege, Hastings, Hall, and O'Neill soils, and also include all the bottom-land soils. The most extensive are the Colby soils which occur in all parts of the loessial uplands where erosion is severe, the largest developments being in the northern part of the county. The topsoils are prevailingly thin and light in color; soil horizons, where present, are poorly developed; and the raw calcareous loess, from which the soils have developed, is exposed in numerous places.

None of the soils throughout the small area of sandy uplands in the northeastern part of the county has made much progress in development, largely on account of the loose incoherent character of the parent soil material. This area is occupied chiefly by the Valentine and Anselmo soils and dune sand, all of which consist largely of sand. They have light-colored surface layers, are very low in organic matter, and are thoroughly leached of lime.

Scattered basinlike depressions throughout the more nearly level parts of the loessial uplands are occupied by the Scott soil, all areas of which are imperfectly developed on account of poor drainage. Water accumulates in the basins after rains and often remains on the surface of the ground for several weeks. Excessive leaching of the Scott soil has resulted in giving it a thin dark topsoil, a light-colored and usually laminated subsurface layer, and a dense claypanlike gray or bluish-gray subsoil. The dense subsoil contains scattered round ferruginous pellets ranging from one-eighth to one-fourth inch in diameter, and it extends to a depth ranging from 5 to 6 feet, where it rests on the parent Peorian loess. The entire soil, as well as the upper 3 or 4 feet of the underlying loessial material, has been leached of its carbonates.

None of the soils of the bottom lands is old enough to have made much progress in soil development. Most of these soils, owing to the rank growth and rapid decay of water-loving grasses, have accumulated much organic matter in their surface layers, and they have very dark-colored topsoils. The subsoils have not developed definite soil horizons. In most places oxidation and aeration have been greatly retarded beneath the surface of the ground by excessive moisture, and the topsoils rest on the unaltered alluvial sediments. The Cass and Sarpy soils have developed on the sandy sediments and the Lamoure soils on the silty deposits. The Cass and Lamoure soils have dark-colored topsoils, and the topsoil of the Sarpy soil is gray. None of these soils, except the Lamoure, has accumulated much lime.

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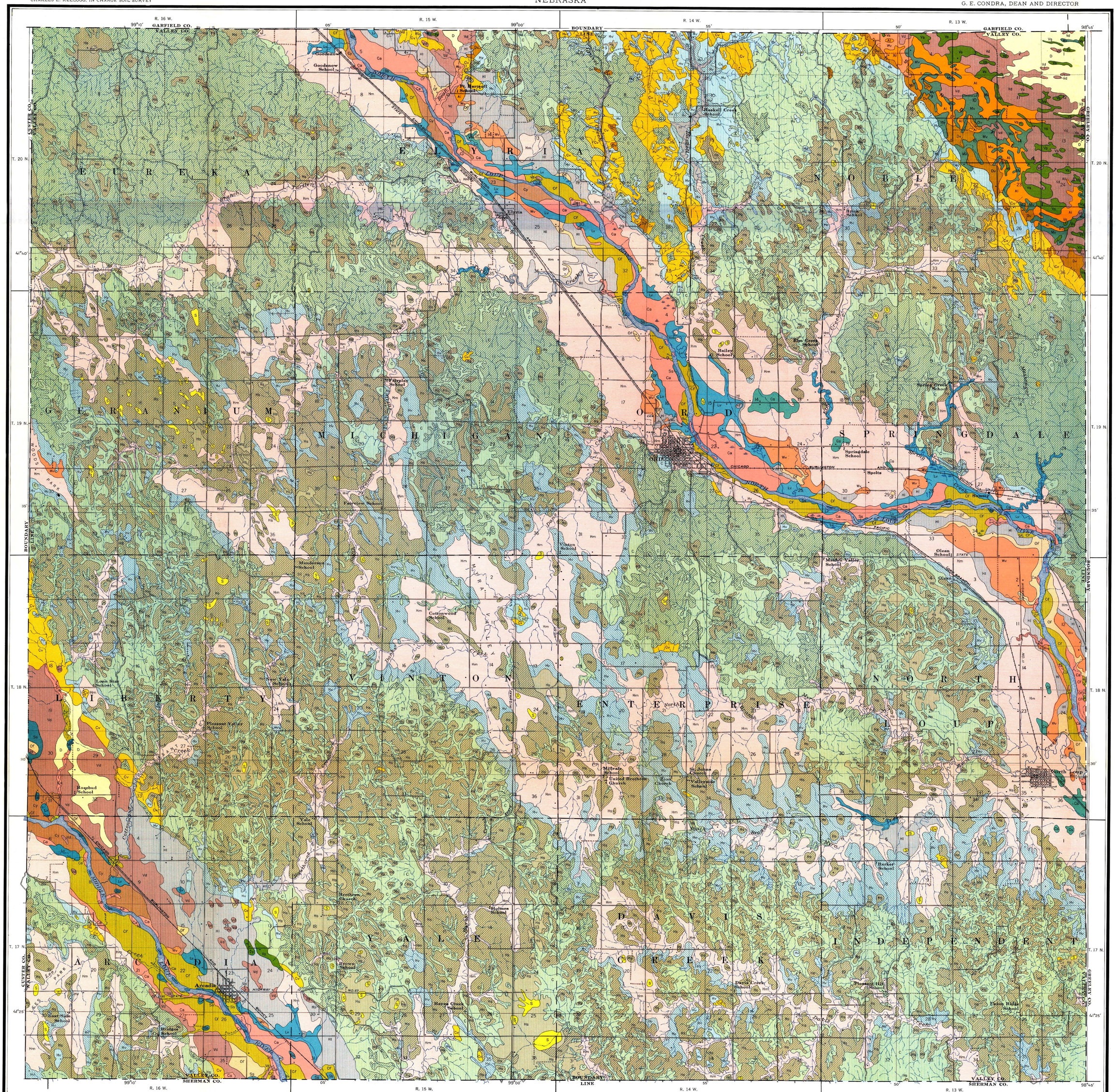
SOIL MAP
VALLEY COUNTY
NEBRASKA

UNIVERSITY OF NEBRASKA
STATE SOIL SURVEY DEPARTMENT OF THE
CONSERVATION AND SURVEY DIVISION
G. E. CONDRA, DEAN AND DIRECTOR



LEGEND

- Anselmo loamy sand — Al
- Hastings silt loam — Hs
- Cass loamy fine sand — Cy
- Rolling phase — Hs
- Cass fine sandy loam — Cf
- Holdrege very fine sandy loam — Hv
- Cass very fine sandy loam — Ca
- Colluvial phase — Hv
- Colby very fine sandy loam — Cv
- Lamoure very fine sandy loam — Lv
- Colby silt loam — C
- Marshall very fine sandy loam — Mv
- Broken phase — C
- O'Neill fine sandy loam — Of
- Crete silt loam, Terrace phase — Cs
- Sarpy sand — Ss
- Dickinson very fine sandy loam — Dv
- Scott silt loam — S
- Hall very fine sandy loam — Hl
- Valentine sand — Vd
- Hall silt loam — Hm
- Valentine loamy sand — Vs
- Dune sand — D
- Waukesha very fine sandy loam — Wv
- River wash — Rv

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort.
- Secondary roads and Trails
- Railroads Steam and Electric
- Bridges, Ferry
- R.R. crossings, Tunnel
- Ford, Dam
- School or Church Cemeteries
- Mine or Quarry Mine dumps Made land
- Bluff, Escarpment Rock outcrop and Triangulation station
- Stony and Gravelly areas
- Soil boundaries
- Boundary lines
- Boundary lines
- Boundary lines
- U.S. township and section lines

RELIEF
(Printed in brown or black)

- Contours Depression contours
- Prominent Hills Mountain Peaks
- Sand, Wash, and Sand dunes
- Shore and Low-water line, Sandbar

DRAINAGE
(Printed in Blue)

- Streams
- Lakes, Ponds Intermittent lakes
- Intermittent streams
- Springs, Canals and Ditches, Flumes
- Swamp Salt marshes
- Submerged marsh Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

Thomas D. Rice, Inspector, District 3.
Soils surveyed by R. L. Gemmell, in charge, E. A. Nieschmidt and R. H. Lovald, Nebraska Soil Survey, and F. A. Hayes and S. Rankin Bacon, U. S. Department of Agriculture.

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Field Operations
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